New York Eye and Ear Infirmary of Mount Sinai

Department of Ophthalmology

Staying Focused: Our Third Century of Leadership in Education

BEST HOSPITALS U.S.News & WORLD REPORT OPHTHALMOLOGY 2021-22

CONTENTS

Message From the Department Of Ophthalmology Leadership

Fresh off our bicentennial year, we immediately began writing the next chapter of our storied history with a narrative driven by the prominent role of technology, research, and education in supporting the nationally recognized clinical care we provide to patients and the community at large. Consider some of the ways New York Eye and Ear Infirmary of Mount Sinai (NYEE) left its imprint on the field of ophthalmology over the past year, as described in this report:

- We enhanced the capabilities of, and readied for clinical trials, the country's first ophthalmic robotic assistant, a highly sophisticated device that promises to change the face of micro-interventional ophthalmic surgery.

- We implemented a model tele-consult program with stroke teams at several of Mount Sinai's largest hospitals to treat patients with eye stroke, collapsing the time it typically takes to get a diagnosis so that treatment can begin within the narrow window needed to ensure the best outcomes.

- Our researchers uncovered a novel gene therapy approach to save retinal ganglion cells and preserve vision in the treatment of severe injuries involving the optic nerve and blinding diseases like glaucoma.

Our commitment to the next generation of ophthalmologists through the largest academic training program in the country remains a top priority, as evidenced by our new course in ophthalmic micro-interventional robotic surgery for residents and fellows. The course, at the Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center, offers NYEE trainees exposure to the next level of technology and precision surgery unavailable anywhere else in the United States. We also completed the inaugural year of our Joint Internship Program, which is affording our trainees valuable exposure to ophthalmic care and even research before they begin their first year of residency.

Through our cutting-edge research and clinical programs, technology permeates everything we do at NYEE. That dynamic will intensify as we draw on our rich capabilities in the areas of imaging, genomics, mathematical modeling, stem cells, and artificial intelligence to uncover upstream factors that contribute to such common and complex diseases as macular degeneration and glaucoma. We are also investigating the ocular biomarkers of these diseases and many others with the help of artificial intelligence and sophisticated imaging modalities like OCT angiography and adaptive optics.

At the same time, we are preparing for fundamental change to our downtown Manhattan campus, and to the way we deliver service to not just individual patients but communities and entire populations. We remain firmly bound to the founding principles that have allowed us to grow and excel in our specialized field of medicine. That means an unwavering commitment to programs and investments that will enable us to continue to lead in clinical care, education, and research for the next 200 years.

James C. Tsai, MD, MBA
President, New York Eye and Ear Infirmary of Mount Sinai
Chair, Department of Ophthalmology, Icahn School of Medicine at Mount Sinai and Mount Sinai Health System

Paul A. Sidoti, MD
Site Chair, Department of Ophthalmology, New York Eye and Ear Infirmary of Mount Sinai

Louis R. Pasquale, MD, FARVO
Site Chair, Department of Ophthalmology, The Mount Sinai Hospital and Mount Sinai Queens

Reimagining NYEE For the Next Century Of Growth

NYEE-branded ambulatory surgery center in Manhattan.*

The twenty-first century health care landscape is being reconfigured by changes that are breathtaking in their scope and intensity. They include the migration of patient care from the hospital out to the community, the implementation of site-neutral payments and their impact on hospital revenue, and the introduction of bold new technologies such as telemedicine and artificial intelligence, all of which will affect how institutions deliver their patient care services. Most recently, the unremitting COVID-19 pandemic is forcing every health care system to intelligently adapt to and invest in solutions to meet the challenges of future disruptions to patient care.

New entrance to Mount Sinai Beth Israel main campus at 17th Street, co-branded with NYEE.*

As New York Eye and Ear Infirmary of Mount Sinai (NYEE) embarks on its third century of growth and innovation, the institution is confronting these changes head on. This will require strategic implementation of a sustainable model that allows the institution to continue to grow and remain economically strong, while still maintaining its mission to serve the community.

"We're going to thrive for the next two centuries as we remain more committed than ever to our mission of world-class patient care, scientific discovery to find novel treatments for ocular diseases, and unparalleled education of future ophthalmic leaders," says James C. Tsai, MD, MBA, President of NYEE and Chair of the Department of Ophthalmology at the Icahn School of Medicine at Mount Sinai and the Mount Sinai Health System. "But there will likely be major changes to our campus as we open up NYEE-branded ambulatory surgery center settings, and as we modernize our aging facilities to make them compatible with health care in the twenty-first century."

NYEE is partnering with the Mount Sinai Health System to obtain the resources necessary to bring this new ambulatory care blueprint to fruition. The new ambulatory surgical center near Manhattan's Madison Square Park will add another patient care site to NYEE's growing portfolio of faculty practice sites as well as affiliated clinical sites and teaching institutions throughout the New York metropolitan region. And the institution is collaborating with the Health System to modernize and colocate its clinical, educational, and research resources near and around the campus of Mount Sinai Beth Israel, a few blocks away from the existing NYEE campus.

Beyond infrastructure, the future of our institution will be molded by the wide-ranging research that is recognized internationally. That initiative is powered by our rich capabilities in the areas of imaging, genomics, mathematical modeling, artificial intelligence, stem cells, and viral vectors. "We'll continue to support basic research that's dedicated to the preservation and restoration of vision, and which creates opportunities for our clinical faculty to translate science into advanced patient care," emphasizes Louis R. Pasquale, MD, FARVO, Director of the Mount Sinai/ New York Eye and Ear (NYEE) Eye

**Preliminary renderings, subject to change.*

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continued from page 7

The Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center*

and Vision Research Institute and Site Chair of Ophthalmology, The Mount Sinai Hospital and Mount Sinai Queens. "That means working as we have in the past with pharmaceutical and industry partners on research with clinical potential, while expanding projects initiated by our own clinician-scientists, and those supported by the NIH."

Underscoring the broad sweep of our research is the work of talented scientists like Timothy A. Blenkinsop, PhD, Associate Professor of Ophthalmology, Cell, Developmental, and Regenerative Biology, whose lab is making considerable headway in unraveling the biology of the human eye to uncover mechanisms of cell regeneration. The Department of Ophthalmology is streamlining the work of its research faculty by organizing them into teams to tackle challenges such as finding upstream factors that contribute to complex diseases through novel analytical epidemiology and big data approaches. Also, teams are being assembled to discover ocular biomarkers for systemic disease with the help of artificial intelligence and NYEE's sophisticated imaging capabilities, and to use stem cell and viral vector technologies to enable the long-sought-after reconstitution of retinal cells.

Education is also central to NYEE's blueprint for the future. "We're not just continuing our training programs for residents, fellows, and medical students, but actually growing and improving them, knowing how essential they are to providing the highest-quality clinical care to our patients," says Paul A. Sidoti, MD, Deputy Chair for Education and Site Chair of Ophthalmology, NYEE. The centerpiece of that effort is the

Ambulatory Eye Clinics: Reception area and exam room*

Modernized Emergency Department at Mount Sinai Beth Israel, co-branded with NYEE, with dedicated exam rooms for Ophthalmology and ENT cases.*

Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center, one of the most advanced training labs in the country.

As NYEE looks forward into its third century of growth, the institution's leadership recognizes that fundamental change will impact virtually every part of it. "This kind of change can be unsettling for some, but it's also an incredible opportunity to grow and improve on the original mission of NYEE," asserts Dr. Tsai. "It's a chance for us to draw on our trove of experience over the past 200 years to reimagine how we will remain in the forefront of patient care and innovation going forward—something our predecessors have had to do in years past."

While NYEE's present location at East 14th Street and Second Avenue in Manhattan's East Village has been its home since 1856, the site is actually NYEE's eighth location. "Over the years, the institution has had to evolve and grow, and that often meant relocating," says Dr. Tsai. "But what has been constant is the collective spirit and ethos, the commitment to our mission to serve the community. That is the very core of NYEE: our incredible faculty, voluntary physicians, staff, and trainees infused with the spirit of our founders to serve the community, train ophthalmic leaders of tomorrow, and move the field of ophthalmology forward with breakthrough innovation. And we will take that esprit de corps with us no matter where we are situated."

The Shelley and Steven Einhorn Clinical Research Center: Waiting room and ophthalmic imaging center*

**Preliminary renderings, subject to change.*

Oldest Eye Hospital in America Is Hitting a New Stride With Its Training Program

As New York Eye and Ear Infirmary of Mount Sinai (NYEE) redraws its operational blueprint to meet the demands of a pandemic-driven world, it remains more committed than ever to expanding its educational program for ophthalmic residents and fellows—one of the largest and most respected training initiatives in the country.

"Education is basic to our mission of providing outstanding clinical care, and for that reason, our program to train the next generation of ophthalmologists will not only remain a top priority for New York Eye and Ear, it will continue to grow and improve in the years ahead," says Paul A. Sidoti, MD, Deputy Chair for Education and Site Chair of Ophthalmology for NYEE.

There is no better marker of that commitment than the novel Joint Internship Program, which notched its first-year anniversary in July 2021. A special curriculum was developed for the 10 participating students, whose one-year internship at Mount Sinai Beth Israel now includes nine months of general medicine and three months of ophthalmology training at NYEE. According to Harsha S. Reddy, MD, Ophthalmology Residency Program Director and Site Director for Oculoplastics, Orbital, and Reconstructive Surgery at NYEE and Mount Sinai Beth Israel, that tailored curriculum teaches students the basics of the ophthalmic exam and exposes them to each of the subspecialty clinics at NYEE, as well as the Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center.

"We saw dramatic evidence of how these trainees were able to develop their skills in just three months here, prior to starting their first year of residency," says Dr. Reddy. A number of trainees, he adds, took the Joint Internship Program a step further by using it as a platform to begin research projects.

Change is also critical to the future of the Buxton Microsurgical Education Center, where students learn and practice in a wet lab setting the intricate microsurgical skills they'll soon bring to patients in the operating room. Under way are sophisticated audio-visual improvements to this premier site. Specifically, high-resolution video cameras are being installed at four of the wet lab's 16 microscope-equipped training stations, allowing residents to tape their practice sessions and then relay them to faculty members to review and critique synchronously or at a later time. By the same token, the new capabilities will allow faculty to videotape surgical procedures and techniques in the lab, then store them in an online library for ready access by residents as part of their surgical training.

"The AV upgrades will allow us to formally integrate lab activity into the curriculum," explains Douglas F. Buxton, MD, Clinical Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai, and son of Jorge N. Buxton, MD, the first chief of cornea service at NYEE and a champion of modern microsurgery. "The new 'smart' cameras are connected to the internet, which will make it possible to stream real-time lab activity to any location. And that creates the opportunity for worldwide educational classes from NYEE."

Technologically, the Buxton lab is already among the leading ophthalmic surgical training sites in the country. In 2006, a virtual reality

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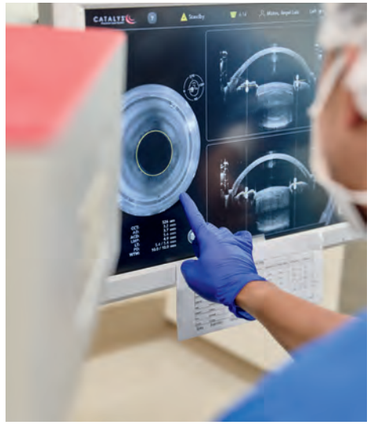
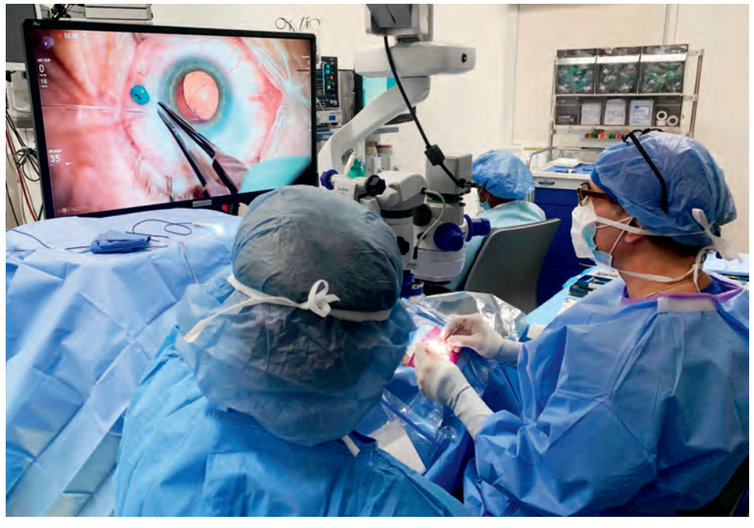
AUPO SCOR skills transfer course conducted in June at NYEE. **Top:** Trainees developing advanced phacoemulsification skills including stop and chop and phaco chop in the Buxton Microsurgical Center. **Bottom:** A dry-lab session with trainees practicing advanced anterior segment skills.

continued from page 11



Left to right: Bernadette Maliwat, RN, voluntary attending John Flanagan, MD, and Michael Chua, MD, resident class of 2021, performing cataract surgery



Ronald Gentile, MD, a retina specialist, performing vitrectomy surgery using the Ngenuity 3D Visualization System.

EyeSi Surgical simulator was installed, enabling ophthalmologists-in-training to experience simulated surgery for development of hand-eye-foot coordination before transitioning to the operating room. And recently, the country's first robotic assistant for ophthalmic microsurgery entered the lab, where residents and fellows will soon have the unique opportunity to train virtually on the device through special curricula created for retinal and glaucoma surgery.

In acknowledgment of the stature NYEE's training program has achieved, the Association of University Professors in Ophthalmology (AUPO) used the specialty hospital's campus as a beta site in June 2021 for honing advanced cataract surgery skills and techniques. The program, known as SCOR (Surgical Curriculum for Ophthalmology Residents), brought together 15 residents throughout the New York metropolitan area for a combination of online and hands-on training prior to rolling out the first wet lab course to 74 third-year residents at a AUPO-sponsored event in the fall of 2021. "The small scale wet lab we held at NYEE generated very positive feedback from trainees and faculty alike, and that's enabling us to further improve the curriculum to ensure the best possible training experience for residents," says Steven Feldon, MD, MBA, Executive Vice President of AUPO.

Another significant training-related event has been NYEE's implementation of the Ngenuity® 3D Visualization System. This state-of-the-art technology provides surgeons with enhanced magnification, detail, and depth perception for visualizing the internal structures of the eye. Instead of peering through a microscope during surgery, ophthalmologists put on special 3D glasses and look at an 80-inch, high-definition video monitor that projects three-dimensional images of the eye in real time. By allowing trainees to view the fine detail of what the surgeon sees in the OR, the 3D Visualization System constitutes a groundbreaking teaching tool at NYEE.

"The Ngenuity system speaks to our commitment to innovation and staying in the forefront of surgical technology," says Dr. Sidoti. "And just as importantly, it speaks to our continued emphasis on education as the most powerful pathway to those goals."

Recognizing A Legacy of Passion and Dedication to Microsurgery And Education

Left to right: Richard B. Rosen, MD, James C. Tsai, MD, Amalia Buxton, Douglas F. Buxton, MD, and Julia Fallon, MD

Since 2004, a newly renovated, fully equipped wet lab at NYEE known initially as the Jorge N. Buxton, MD, Microsurgical Education Center has bridged the gap between academic medicine and the operating room for ophthalmologists-in-training.

When it came time to name the Center, Dr. Buxton was a natural choice. In 1963, he was appointed Surgeon-Director and the first Director of Cornea Service at NYEE. Later he was named Executive Surgeon and Chair of the Medical Board. Beyond titles, he had earned a reputation as a renowned corneal surgeon and a fierce champion of modern-day microsurgery.

"He was the original microsurgical trainer at this hospital, and was passionate about excelling in procedures performed under magnification with delicate microscopic instruments and materials," says his son, Douglas F. Buxton, MD, FACS, Surgeon Director at NYEE and Clinical Professor of Ophthalmology, who has taught at the Center for the past 25 years.

As the hub for hands-on training, the lab offers a range of courses that include corneal transplantation, glaucoma filtering and tube implant surgery, strabismus surgery, retina surgery, and suturing and incision techniques. The addition in 2006 of the virtual reality EyeSi Surgical simulator and, most recently, the Preceyes surgical robotic assistant technology, have helped keep the Center on the cutting edge of ophthalmic surgical training in the United States.

2004 grand opening of the Jorge N. Buxton, MD, Microsurgical Education Center at NYEE. **Left to right:** Joseph Arrigo, MD, Douglas F. Buxton, MD, Arthur Tortorelli, Amalia Buxton, J. Robert Rosenthal, MD, Young Bin Choo, MD, Christopher Linstrom, MD, and Richard B. Rosen, MD

Ensuring that the lab remains top-tier, the Jorge N. Buxton, MD, Microsurgical Education Foundation was created by Dr. Buxton in 2010. Under his executive directorship, the Foundation has provided funding over the years to promote the Center's core mission: offering ophthalmic microsurgical training in an environment thoroughly grounded in experimentation, innovation, and excellence.

Seventeen years later, the lab and also the foundation are getting a new name—the Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center—in recognition of the younger Dr. Buxton's unwavering philanthropic support of NYEE residency and fellowship education.

For One Researcher, The Fight to Cure Blindness Is Personal

Timothy Blenkinsop, PhD, in Central Park.

continued from page 15

A Promising New Pathway Toward Retinal Cell Replacement Therapy

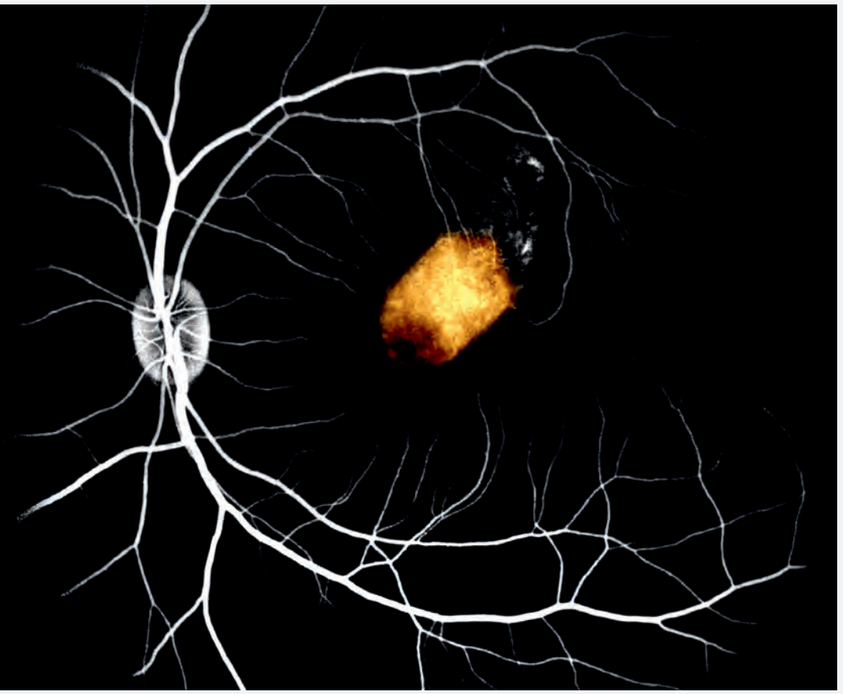


Image illustrates transplantation of adult retinal stem cell-derived retinal pigment epithelial cells (hRPESC-RPEs) on PET scaffolds successfully engrafted underneath the macula of a non-human primate model after 3 months. This is visualized live *in vivo* by combined fundus photography and fluorescein angiography. This demonstrates the feasibility of using hRPESC-RPE transplants to replace defective RPE as a possible treatment for macular degeneration.

Image courtesy of the authors.

Timothy A. Blenkinsop, PhD, needs no reminder of why reporting each morning to his science lab at the Icahn School of Medicine at Mount Sinai in Manhattan feels so effortless.

"Scientific inquiry, particularly in the area of translational research, fills me with at least the hope that my efforts may eventually contribute to improving people's lives," says Dr. Blenkinsop, an Associate Professor and investigator who is focused on better understanding the biology of the human eye and its mechanisms of regeneration. Just as vigorous, though, is his appreciation for the awesomeness of science. Or, as he puts it, "Being the first to discover a new phenomenon always fills me with awe. For a brief moment, I alone hold a secret about human biology, which is then shared with others: this is a fleeting feeling of elation I continue to chase."

Dr. Blenkinsop's work is also personal. His brother lost his eyesight 15 years ago in a devastating automobile accident, when Timothy was a PhD neuroscience student at NYU. Soon afterward he switched his studies from motor coordination to vision, and translational research became his new mantra. The Mount Sinai/New York Eye and Ear (NYEE) Eye and Vision Research Institute (together with the Black Family Stem Cell Institute) has given him a generous stage to carry out that mission. "What I'm hopefully doing is laying the foundation for therapies that could one day help people with severely impaired vision. People like my brother."

Macular degeneration often begins in the cells of the retinal pigment epithelium (RPE), as do dozens of other RPE-related diseases that have triggered vision loss in upwards of 200 million people globally. For that reason, researchers have been scrambling to find the safest and most effective way to rescue or even restore vision through RPE cell replacement therapy.

The Mount Sinai/New York Eye and Ear (NYEE) Eye and Vision Research Institute has now taken this research an important step further with the finding that retinal cells derived from the eyes of human cadavers are able to survive and partially regain their function when transplanted into the maculae of non-human primates.

The results were published in the February 2021 issue of the *Stem Cell Reports*.

"Our findings suggest that human-derived RPE stem cells are a safe and highly promising source of cell replacement therapy for patients with vision loss due to RPE dysfunction," says Timothy A. Blenkinsop, PhD, Associate Professor of Ophthalmology, Cell, Developmental, and Regenerative Biology, Icahn School of Medicine at Mount Sinai. "By taking advantage of eye donations as an alternative to embryonic and induced pluripotent stem cells, cadaver-derived ocular cells offer a distinct opportunity for donor compatibility with a virtually unlimited supply. Another special attribute these cells have is they have lived a lifetime as RPE and therefore may be more mature and stable than other stem cell sources."

For their study, the Icahn Mount Sinai team and laboratory partners with research centers in Singapore collaborated to surgically implant, underneath the primate's macula, healthy RPE cells extracted from donated human eyes. As they demonstrated for the first time, these cells remained stable, are safe, and were able to recover and function under the retina for at least three months without serious side effects, such as immune system attack or light sensitivity. Among the most encouraging findings was that the transplanted RPE assumed in part the normal function of the RPE, which is to support the photoreceptors.

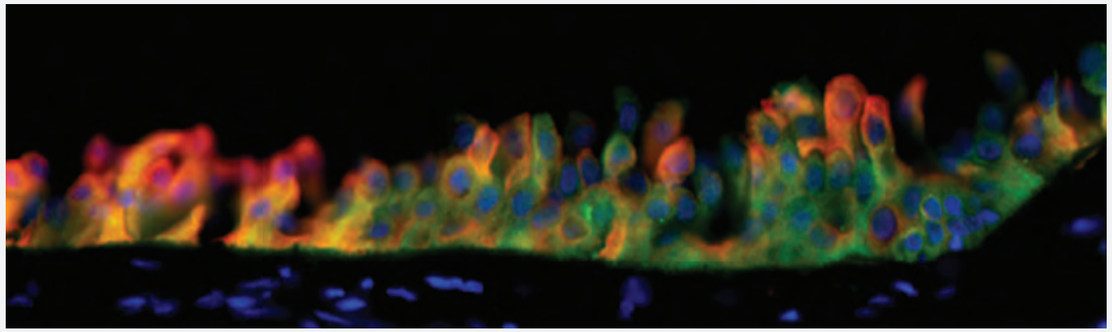
The clinical goal of replacing dysfunctional RPE with healthy cells is to prevent further retinal atrophy and vision loss, including blindness. If dormant photoreceptors are still present within the diseased area, however, replacement technology might also be able to actually restore lost vision. To explore that potential, Dr. Blenkinsop plans to launch a study that draws on the same models of his recently completed investigation. He believes that work should provide an additional rationale for initiating clinical trials that transplant cadaver-derived retinal pigment epithelium cells into the eyes of humans.

"While we still do not know which source will ultimately lead to an effective cell replacement therapy in humans, all options must continue to be investigated," Dr. Blenkinsop maintains. What gives cells from cadaver human eyes a clear advantage, however, is their abundant and diverse supply. More than 100,000 eyes are donated annually to eye banks in the United States alone, and each of those donations could be expanded 100-fold, thanks to the number of usable cells for transplantation each could yield. What's more, these stored cells could be matched to individual patients through blood and human leukocyte antigen typing—in the same manner that patients and donors are matched for heart or lung transplantation—to minimize the chance of immune rejection.

"We're still a few years away from human clinical trials," Dr. Blenkinsop notes, "but the results of our latest research leave us greatly encouraged that we've created a durable model that could potentially help countless numbers of patients by replacing lost or damaged RPE cells."

Racing Against Time to Discover a Gateway to COVID-19 Transmission

As face masks became commonplace in the wake of the pandemic, researchers from the Mount Sinai/New York Eye and Ear (NYEE) Eye and Vision Research Institute offered concrete evidence that another form of protection may be necessary. The team showed that SARS-CoV-2, the virus that causes COVID-19, can invade the body through not just the respiratory tract, but also the surface cells of the eye, and that protective eyewear might be advisable, particularly when people spend extended periods in areas with poor ventilation such as an airplane or restaurant. The findings were published in the journal *Cell Stem Cell* (July 2021).



Limbal region of the cornea showing immunofluorescent staining of SARS-CoV-2 in green and the ACE2 receptor in red in the cornea of the human eye

Timothy A. Blenkinsop, PhD, Associate Professor of Ophthalmology, Cell, Developmental, and Regenerative Biology, Icahn School of Medicine at Mount Sinai, was one of the lead investigators. "When patients infected with the virus started complaining about eye problems, we were curious to know if SARS-CoV-2 was present in the ocular postmortem tissue of individuals positive for SARS-CoV-2," he says. "And through our research, we showed for the first time that viral infection is possible through the ocular surface epithelium, including corneal, limbal, and scleral cells. In fact, the limbal region between the cornea and sclera had by far the highest SARS-CoV-2 viral titers."

To determine the susceptibility of the human eye, scientists developed in the lab a whole-eye model using human pluripotent stem cells (hPSC). After exposing the hPSC-derived model to SARS-CoV-2, they again found that the putative limbal cells were preferentially infected. They performed single-cell RNA sequencing to gain more insight into the biology of the infection, namely, which pathways are activated and which are shut down. They found that SARS-CoV-2 suppresses the innate immune system in the same manner as found in cells of both the respiratory and intestinal tracts. SARS-CoV-2 hijacks the transcriptional machinery suppressing cellular function to promote viral replication.

Another question they asked was why limbal cells were preferentially infected. Do limbal cells exhibit the machinery for infection, which includes the receptor ACE2 and the associated host protease TMPRSS2? The well-known spike protein of SARS-CoV-2 tethers itself to ACE2, while TMPRSS2 cleaves ACE2, enabling the virus to invade the host cell and replicate. "We learned that ACE2 and TMPRSS2 are preferentially expressed in the limbal cells of the eye, so the necessary machinery for SARS-CoV-2 entry is already in place," explains Dr. Blenkinsop. "The bottom line from our research is that the eye is a potential vector for infection from SARS-CoV-2."

In addition to broadening the scientific community's knowledge of the biology of the virus, the Mount Sinai-led research team advanced useful suggestions on how it might be better controlled. "Handwashing is important because whenever we subconsciously rub our eyes, we may be transferring the virus," Dr. Blenkinsop points out. "And if we're going to be in the same indoor space with the same recycled air for more than a half-hour, I would recommend eyewear to be on the safe side. Given the Delta variant is more transmissible, vigilance is needed more now than ever before."

An Innovative New Role for OCT Angiography in the Battle Against Sickle Cell Retinopathy

Among the debilitating effects of sickle cell disease, which often strikes in the prime of life, is sickle cell retinopathy, a condition that may go undetected until it has caused permanent damage to the eye. That picture has turned considerably brighter, however, with the development by researchers at New York Eye and Ear Infirmary of Mount Sinai (NYEE) of an innovative new technique for sequential imaging of retinal blood flow. In sickle cell patients, this technique can reveal how the disease is progressing, as well as the effectiveness of treatment regimens such as hydroxyurea. Their work was reported in a study published online in the May 2021 issue of *Biomedical Optics Express*.

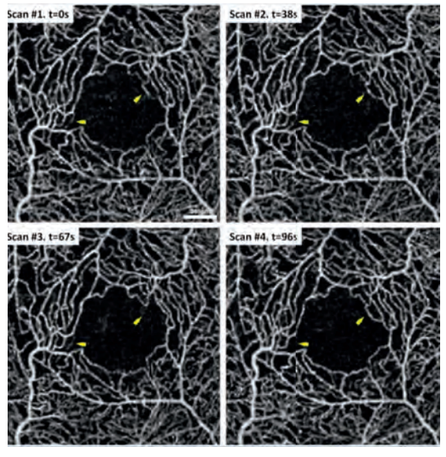


Fig. 1: OCT Angiography scan sequence demonstrating intermittent capillary filling (frames 4 of 10). This is a sickle cell HbSS disease patient on hydroxyurea treatment. Yellow arrows point to two capillary segments bordering the foveal avascular zone of the macula which demonstrate intermittent capillary perfusion during the 10 scan sequence. The time of image acquisition is seen in the upper left corner of each OCT-A scan.

"For the first time we've shown how OCT (optical coherence tomography) angiography can be used to evaluate the immediate status of sickle cell disease using dynamic retinal imaging that depicts microscopic changes in blood flow in the smallest blood vessels," says Toco Chui, PhD, Director of the David E. Marrus Adaptive Optics Imaging Laboratory at NYEE, and senior author of the study. "This approach allows us to noninvasively monitor the retinal microcirculation over time and assess a sickle cell patient's condition before or after initiation of therapy."

Sickle cell disease is an inherited red blood cell disorder that afflicts about 10 percent of African Americans. A mutation in the hemoglobin gene causes the protein to fold abnormally, resulting in red blood cells that distort to a "sickled" shape when stressed. These misshapen cells clump and jam the blood flow in capillaries, which become inflamed and occluded. Progressive regions of blocked circulation can lead to loss of vision in the retina, which may ultimately result in blindness.

Currently, ophthalmologists rely on static images from single scans of the retina, a practice that fails to capture the dynamic nature of the disease process. OCT angiography provides access to the most delicate capillaries and the ability to measure and map microscopic vaso-occlusive events across short- and long-term intervals. In their analysis of 27 patients, NYEE researchers imaged each subject 10 times in a row over a 10-minute span. An hour later, they repeated the procedure to determine which blood vessels were repeatedly opening and closing. From these studies they were able to characterize the level of disease burden and the current activity of the sickle cell disease for the particular patient.

"We learned from our study that patients with no active sickle cell retinopathy show minimal intermittent fluctuation in capillary blood flow," explains co-author Richard Rosen, MD, Chief of Retina Service, Distinguished Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai, and Vice Chair and Director of Ophthalmology Research at NYEE. "In patients with more frequent temporary capillary blockage there is probably a higher risk of permanent closure, which can lead to significant vision loss."

This novel use of OCT angiography, a relatively new technology that NYEE has been in the vanguard of developing, could be an important tool in the armamentarium of clinicians who take care of patients with sickle cell disease. "It's often impossible for these physicians to gauge the impending danger of the sickling condition until the patient experiences vision loss," observes Dr. Chui. "That's why OCT angiography could be a game changer, leading to earlier diagnosis of retinal issues and potentially avoiding irreversible blindness and vascular complications in other parts of the body."

Researchers speculate that the technology could have implications that stretch well beyond sickle cell disease. "Microcirculation in the capillaries of the retina provides a unique window on what is happening in other parts of the body, like the brain and major organs," says Dr. Rosen. "For that reason, OCT angiography could provide a strong platform for detecting a variety of circulation threats in a non-invasive way."

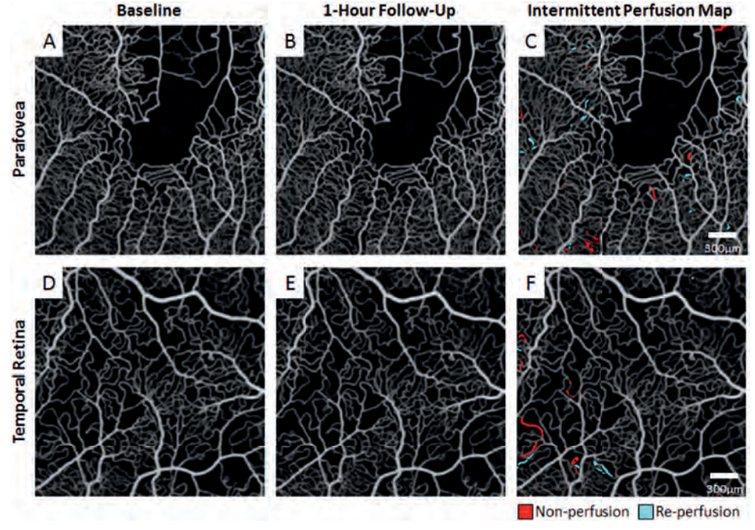


Fig. 2: Labeling of non-perfused and re-perfused capillaries. Averaged OCT angiography images of a sickle cell HbSC disease patient with non-perfused segments around the fovea (top row) and enlarged inter-capillary spaces in the temporal retina (bottom row) for the baseline (A & D) and 1-hour follow-up (B & E) imaging sessions. Intermittently filled capillary segments are labeled as non-perfusion (red) when they are filled at baseline but not at 1-hour follow-up (C & F). Non-filled segments at baseline which re-appear at 1-hour follow-up are considered as re-perfusion (cyan) (C & F).

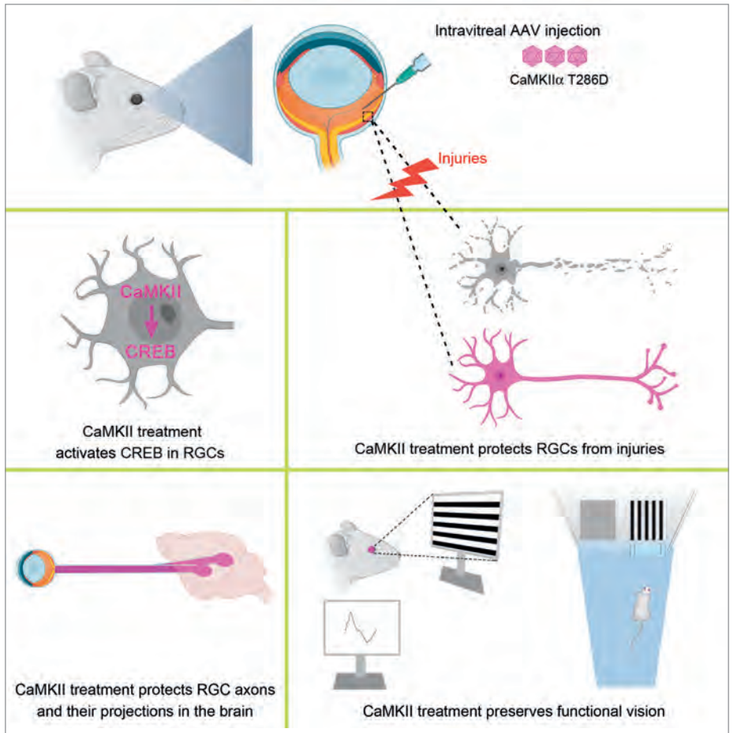
A Novel Gene Therapy Approach to Help Prevent Retinal Vision Loss

Over the past decade, Bo Chen, PhD, has increasingly drawn national attention for his breakthrough work in gene therapy to save and even restore the sight of people with degenerative retinal disease. Dr. Chen, Associate Professor of Ophthalmology, and Neuroscience, and Director of the Ocular Stem Cell Program at the Icahn School of Medicine at Mount Sinai, has now taken his lab's research an intriguing step further with a promising gene therapy approach to protecting and revitalizing retinal ganglion cells compromised by severe injury to the optic nerve from diseases like glaucoma.

In a paper in the journal *Cell* (August 2021), the investigator reported how the reactivation of a key enzyme known as CaMKII and its downstream signaling in retinal ganglion cells through gene therapy provided robust protection of retinal ganglion cells and preserved vision in multiple diseases and injury mouse models. "We uncovered evidence for the first time that CaMKII is a key regulator of the survival of retinal ganglion cells in both normal and diseased retinas, and could be a desirable therapeutic target for vision preservation in conditions that damage the axons and somas of retinal ganglion cells," says Dr. Chen, who moved his lab three years ago from Yale School of Medicine to Mount Sinai/New York Eye and Ear (NYEE) Eye and Vision Research Institute.

Dr. Chen and lab assistant in his laboratory

Dr. Chen's work could prove particularly consequential for glaucoma, the leading cause of irreversible visual impairment worldwide. Glaucoma affects an estimated 76 million people, some of whom will progress to blindness despite aggressive treatment to reduce their intraocular pressure. As Dr. Chen puts it, "The need for neuroprotective strategies to save vulnerable retinal ganglion cells has never been greater."



Graphical Abstract: CaMKII-CREB signaling plays a major role in the maintenance of retinal ganglion cells (RGCs), and reactivation of CaMKII activity via AAV gene therapy in injury and disease models in mice protects RGCs and preserves visual function and visually guided behavior.

As ophthalmologists are well aware, the biggest hurdle to restoring vision loss from glaucoma and other retinal diseases and injuries is the fact that axons—the long nerve fibers that allow retinal ganglion cells to process visual information by converting light that enters the eye into a signal transmitted to the brain—do not regenerate. For that reason, neuroprotective strategies designed to preserve the cell bodies (which contain the DNA of the retinal ganglion cells) and their axons could be critical to preventing further vision loss.

Dr. Chen and his team investigated whether CaMKII could play such a therapeutic role. They tested the enzyme across a wide range of injury and disease animal models, including optic nerve damage, excitotoxicity (where nerve cells are destroyed by the overactivation of glutamate receptors that result in damage to the cell structure), and two glaucoma models that mimicked the pathophysiology of human disease with both high and normal intraocular pressure. The team learned that CaMKII regulated the survival of retinal ganglion cells across many of these pathologies, and that in the small animal excitotoxicity model, insults to the cell bodies or their axons which form the optic nerve led to inactivation of CaMKII and its downstream signaling target CREB (cAMP response element binding protein).

"Intriguingly, we found that reactivation of CaMKII and CREB provided robust protection for retinal ganglion cells," notes Dr. Chen, "and that CaMKII-mediated protection slowed down the disease progression in both glaucoma models."

Making that reactivation possible was a gene therapy approach deployed by the researchers to introduce a more active type of CaMKII into the original retinal ganglion cells to boost their activity. This modified version of CaMKII—with a mutated amino acid—was transferred to the targeted cells through an adeno-associated viral vector.

"Our research showed that CaMKII could indeed be a valuable therapeutic target to save retinal ganglion cells and preserve vision in treating potentially blinding diseases like glaucoma," says Dr. Chen, winner of the Pew Scholars in the Biomedical Sciences Award given to young investigators showing outstanding promise. "The fact that manipulation of CaMKII would involve a one-time transfer of a single gene only adds to its vast potential to treat serious retinal conditions in humans."

Going Deeper Into the Microworld of Ocular Disease

Retinal imaging has taken another bold leap at New York Eye and Ear Infirmary of Mount Sinai (NYEE) with the development of non-confocal adaptive optics processing that allows for visualization of the eye's microvasculature down to capillaries, the blood cells that move through them, and the aneurysms that develop in diabetes and hypertension. The new enhancement to adaptive optics scanning light ophthalmoscopy (AOSLO) increases the contrast and resolution of the already state-of-the-art imaging platform, promising to provide ophthalmologists with unprecedented opportunities to diagnose and treat ocular disease.

"There are only a handful of systems like this in the world with the ability to show features like the outpouching or herniation of blood vessels that are typical of diabetic retinopathy, and the intermittent flow of red blood cells through capillaries in patients affected with sickle cell retinopathy (Figure 1)," says Richard B. Rosen, MD, Belinda Bingham Pierce & Gerald G. Pierce, MD, Distinguished Chair of Ophthalmology, Vice Chair and Director of Ophthalmology Research at NYEE and Chief of Retina Service for the Mount Sinai Health System. "Non-confocal adaptive optics allows us to see microscopic structures and cellular-level movement with a resolution and clarity never before possible."

Traditional confocal AOSLO improved in vivo imaging of the retinal microvasculature by placing a spatial pinhole at the retinal conjugate plane to include only the direct backscattered light, eliminating multiply scattered (out-of-focus) light. Non-confocal AOSLO, on the other hand, harvests the multiply scattered light to facilitate non-invasive visualization of otherwise transparent retinal vascular structures.

"Quad-detection non-confocal AOSLO allows us to see blood flow, blood cells, and other transparent tissues and cells in the retina with enhanced contrast," explains Toco Chui, PhD, Associate Professor at the Icahn School of Medicine and Director of the David E. Marrus Adaptive Optics Imaging Laboratory and Computational Imaging at NYEE.

Dr. Chui created the image processing software that is now being used with AOSLO hardware installed at NYEE as part of a research collaboration with Alfredo Dubra, PhD, Associate Professor of Ophthalmology at Stanford University. "We hope to take advantage of this approach to explore cellular level regions that have been impossible for us to reach in the past, including retinal ganglion cells—which could be critical for more sensitive glaucoma detection and monitoring—and vitreous macrophages, which are known to play an important role in vitreous-macular interface diseases (Figure 2)."

Dr. Rosen believes that vitreous detachments—a very common condition that affects older adults where the gel-like vitreous shrinks, and pulls away from the surface of the retina—are another important target for non-confocal AOSLO imaging. "We hope it will enable us to study how these cells above the retinal surface are involved in abnormal vitreous detachment, which can lead to macular puckering and holes, frequently requiring surgery to repair."

As these new image processing approaches continue to be refined in the adaptive optics laboratory of Dr. Chui, the potential applications for researchers and clinicians alike are only starting to come into focus. "In many ways, non-confocal imaging fulfills the promise of much of the advanced hardware development that began 25 years ago," says Dr. Rosen. "It's the next big step in being able to explore the microworld of patients."

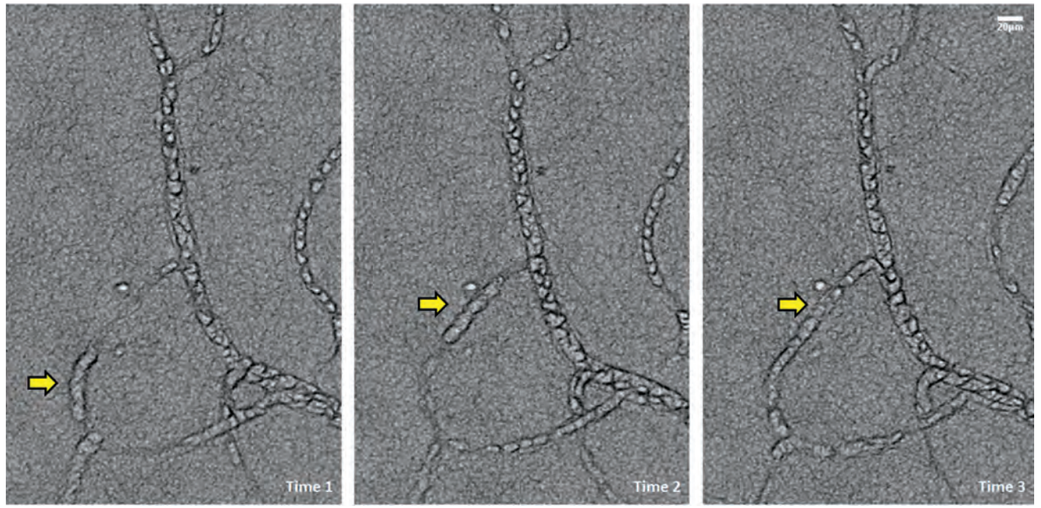


Figure 1: A red blood cell rouleau (aggregation of red blood cells) in a patient with sickle cell disease imaged using non-confocal AOSLO. Yellow arrows indicate the appearance of red blood cell rouleau at Time 1 and Time 2 and disappearance at Time 3.

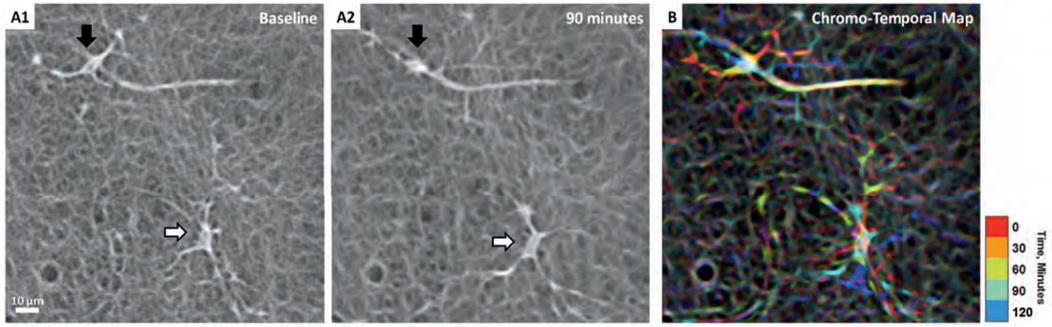


Figure 2: Two macrophages imaged at A1) baseline and A2) after 90 minutes in a healthy subject using non-confocal AOSLO. Arrows indicate shape-shifting of the cell body over time. B) The chromo-temporal map shows the cell translocations over 2 hours. Both macrophages remain relatively stationary while their processes extend and retract in various directions over 2 hours. The background is composed of the framework of collagen protein strands that compose the vitreous gel.

Coffee Alert for Those at High Risk of Glaucoma

Think hard about that third or fourth cup of coffee if glaucoma runs in your family.

That's the message from a new study by Icahn School of Medicine at Mount Sinai researchers that demonstrated the interaction of diet and genetics in glaucoma, the leading cause of blindness in people over 60. The paper, published in the June 2021 issue of *Ophthalmology*, found that individuals with the strongest genetic predisposition to elevated intraocular pressure (IOP) had an increased risk of glaucoma if they also had a high caffeine intake.

"Caffeine consumption by itself is not a robust risk factor for primary open-angle glaucoma," says Louis R. Pasquale, MD, Deputy Chair for Research for the Department of Ophthalmology at Icahn Mount Sinai and Director of the Mount Sinai/New York Eye and Ear (NYEE) Eye and Vision Research Institute, and lead author of the paper. "But if someone has a strong family history of the disease and they drink a lot of coffee, they'd be well advised to consider cutting back to two cups a day."

While researchers have long known that variants in multiple genes are more common in people with glaucoma, the study is the first to pinpoint a large panel of genes that may interact to magnify the risk of glaucoma in high-caffeine consumers. Specifically, investigators found that people in the top 25 percent of the genetic risk score category for high eye pressure who consumed three cups of coffee daily were nearly four times more likely to have glaucoma than those who did not consume caffeine and were at the lowest genetic risk quartile for elevated eye pressure.

For their research, the team led by Dr. Pasquale drew upon roughly 121,000 members of the UK Biobank. This cohort proved to be an invaluable resource inasmuch as it contained robust data on genetics, caffeine consumption, and intraocular pressure of participants. The results confirmed a prior glaucoma study reporting that greater caffeine intake was associated with open-angle glaucoma in people with a family history of the disease.

"Our study suggests that many genes may interact with caffeine to increase or decrease intraocular pressure, though only a handful appear to be statistically significant," explains Dr. Pasquale. "Further research is needed to determine which specific genes and their components are most important, and could thus potentially serve as biomarkers to indicate which individuals are predisposed to higher IOP and glaucoma."

Once those genes are confirmed, they might eventually open the door to widespread genetic testing designed to inform members of the public who are at the greatest risk of high intraocular pressure and glaucoma. Dr. Pasquale suggests that kind of knowledge and awareness could help set the stage for powerful new approaches to battling glaucoma. "Genes are not destiny," he asserts, "and finding environmental and dietary strategies to mitigate the impact of genetics could be a highly effective way to reduce the risk and burden of glaucoma."

Reassurance for Patients With Glaucoma Drainage Implants

As ophthalmologists are well aware, increasing numbers of patients undergoing cataract surgery have in place glaucoma drainage implants—shunts that bypass the eye's natural drain and lower intraocular pressure (IOP). More of a medical mystery is the short- and long-term impact of cataract surgery on the IOP of glaucoma patients with these devices. Is the procedure safe, or does it pose risks for patients whose vision has already been compromised?

New findings by researchers at New York Eye and Ear Infirmary of Mount Sinai (NYEE) should put the minds of both surgeons and patients at ease. In the largest study of its type, published in *Ophthalmology Glaucoma* (November 2020), the team reported that the use of phacoemulsification in patients with glaucoma drainage implants resulted in a reduction in IOP in the first week following surgery, and remained unchanged relative to the preoperative level over the next two years.

"Our study reinforces the fact that cataract surgery can be done safely and prove beneficial to glaucoma patients with drainage implants since it can lower their intraocular pressure on a transient basis, and reduce the number of glaucoma medications needed during that period," says lead author Sze Wong, MD, Assistant Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai. "These findings should help reduce concerns that postoperative inflammation and cytokines released from cataract surgery could potentially stimulate scarring and thereby increase intraocular pressure."

As for the potential mechanisms behind the temporary IOP reduction, Dr. Wong suggests that the irrigation force during phacoemulsification could produce micro-ruptures in the capsule of the drainage device reservoir, thus facilitating drainage of the eye's aqueous humor.

Still, cataract surgery in the company of glaucoma drainage implants is not without risks. Dr. Wong and his team found a number of postoperative complications, including cystoid macular edema (in 10 percent of cases), corneal decompensation (in 6 percent), and choroidal effusion (in 4 percent).

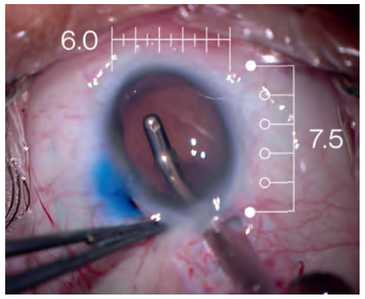
"These surgeries tend to be more complicated than normal cataract procedures, particularly given the higher incidence of mature cataracts in this patient population, and the requirement for pupil expansion," explains Dr. Wong. "That's why physicians need to carefully consider the heightened risks. We recommend checking the central corneal thickness and the corneal endothelial cell density prior to phacoemulsification when a drainage implant is in place. If precautionary steps like these are taken, there's no reason why patients can't be assured excellent outcomes from their surgery."

Cataract Surgery In the Tightest of Spaces

Kira Manusis, MD, Co-Director of Cataract Surgery Services at New York Eye and Ear Infirmary of Mount Sinai (NYEE), knew the patient referred to her in April 2021 for cataract evaluation and surgery would be a challenge. But she didn't appreciate the full dimensions until she posted the case on a global chat room designed to advise clinicians on difficult cases. Thousands of anterior segment specialists are in that chat room, but only one responded.

The case involved a 55-year-old woman whose vision had been greatly impaired over the past two years by hypermature (white) cataracts in both eyes. The real difficulty, though, wasn't the cataracts. It was the patient's corneas, rendered so tiny by a hereditary condition that standard phacoemulsification and intraocular lens implantation in such a crowded surgical space without damaging surrounding tissue would pose a huge technical hurdle. In addition to the microcornea and iris coloboma in each eye, the case was further complicated by the fact that the patient's condition prevented usual imaging and eye measurements, prior to cataract surgery, from being performed.

"We had no idea what the patient's anatomy was going to look like once we got into the eye," admits Dr. Manusis, Assistant Professor of Ophthalmology at Icahn School of Medicine at Mount Sinai. "It was one of the most difficult cases I've ever handled because of all the unknowns and the cramped space in which we had to operate." The anatomy



Top: An unusually small surgical area as illustrated by the surgical tools, with the cornea measuring 6.0 x 7.5 mm in diameter. **Bottom:** Paula Liambas after cataract surgery.

was so small that there were very few comparable human case studies; Dr. Manusis even consulted books on veterinary ophthalmic surgery to help guide her course of treatment.

Not surprisingly, other ophthalmologists around the city who had been approached by the patient's family were loath to take the case on. "It's definitely a feather in Dr. Manusis's cap that she proceeded with this operation because I don't think too many surgeons could have managed it," says the patient's brother, Dean Liambas. It was Mr. Liambas who sought help for his sister, Paula, after her reduced vision caused her to repeatedly bump into objects around the house and fail to visually recognize people she knew well. "At one point we were crossing the street and she didn't see the curb, causing her to trip and fall," he recalls. "I knew then something had to be done."

Prior to the day of surgery, Dr. Manusis's game plan was to perform cataract extraction in each eye (one month apart) under general anesthesia, with three possible surgical pathways. The first—and most preferable—would be to place the intraocular lens into the capsular bag if the anatomy was found to be normal, with adequate zonular support. The second possibility, in the event the capsular bag was too small, would be to cut the haptics—the flanges attached

Paula Liambas with her brother Dean near their home in Queens

to the intraocular lens that fixate the lens in the eye—to size them to the tiny capsular bag. And the third approach, considered a last resort, would be to not insert the intraocular lens, leaving the patient to a future with aphakic glasses.

Once the patient was under anesthesia, Dr. Manusis was able to perform more precise measurements of the corneal diameter. While average corneas measure 10.5 x 11.5 mm vertically and horizontally respectively, Paula's corneas were determined to be 6.0 x 7.5 mm. The axial length of the eye was noted to be 21.7 mm with keratometry readings of 48 x 51 diopters, which would lead to a readily available intraocular lens power. This allowed her to make several modifications to the surgery, including creating a scleral tunnel for the incision and use of a cystotome-assisted capsulorhexis.

To the pleasant surprise of Dr. Manusis and the fellow assisting her, the anatomy of the patient's lens was found to be normal, enabling them to safely proceed with the preferred surgical plan: implanting a normal, though slightly more flexible, acrylic intraocular lens into the capsular bag. And while the extremely tight workspace and reduced visibility due to the miniature-size cornea proved taxing for the surgeons, the 40-minute procedure went well.

How well was evident the next day when Ms. Liambas returned to the surgeon's office to have the patch removed from the eye. "She immediately smiled and clapped her hands because she was seeing 100 percent better than before," remembers her brother, who was by her side throughout the pre- and post-surgical periods.

The procedure on the second eye was also well tolerated by the patient, giving her 20/150 vision in the left eye and 20/200 in the right eye one month after both surgeries. That change has since translated into a much-improved quality of life for Ms. Liambas and her brother. "She's a lot more independent now," Mr. Liambas explains. "Before, I'd say, 'Paula, hold onto my arm so I can guide you.' Now she lets go of my arm and says, 'I got it.'"

When a 'Less Is More' Approach Is Best Medicine for a Newborn

Physicians are hard-wired to do everything possible for their patients. Sometimes, though, the most effective treatment is minimal treatment, a lesson that was recently driven home to Tamiesha Frempong, MD, MPH, Assistant Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai, in the case of a newborn shrouded in medical mystery.

A pediatric resident at The Mount Sinai Hospital alerted Dr. Frempong to the case when he noticed an abnormal red reflex—a reflection from the back of the right eye—as part of a standard test performed on babies at birth. As ophthalmologists know, this is a worrisome sign that can indicate a wide range of pathologies.

An examination by Dr. Frempong of the baby's eye 12 hours after birth revealed "an angry ring of neovascularization," as she puts it, around the border of the pupil and a clot of blood in the front of the pupil on the following day. Upon dilation, the exam also showed a troubling haze on the lens and no view to the retina.

"I was extremely concerned about the presence of blood in the front of the eye, which could be an ominous sign of inadequate blood supply to the back of the eye," says Dr. Frempong. "The baby was also at risk for an aggressive type of glaucoma, which could be potentially blinding, as well as the possibility that the opacity on the lens was a cataract, which would have required surgery within the first month of life. But it wasn't clear why any of this was happening."

Dr. Frempong, an experienced pediatric ophthalmologist, recognized the need for an expert opinion and immediately called on Robin N. Ginsburg, MD, Director of Vitreoretinal Surgery at The Mount Sinai Hospital and Associate Professor of Ophthalmology at Icahn School of Medicine at Mount Sinai. Both doctors appeared at the baby's bedside early the next morning and performed an ultrasound and intraocular pressure check. The tests indicated no retinal detachment, masses, vitreous hemorrhage, elevated intraocular pressure, or inflammation in the back of the eye.

Still, the question remained in Dr. Ginsburg's mind: was the source of the problem new blood vessel growth or the presence of blood from the normal trauma of birth? "I was concerned there could have been a significant vascular event," she explains. "On the other hand, it could have been persistent tunica vasculosa lentis, a condition related to the network of blood vessels encasing the embryonic lens that appears tangled before the baby is born. This condition, she adds, is benign and typically goes away on its own."

As the lead physician on the case, Dr. Frempong continued to pull out all the investigative stops. She tapped her own network of experts nationwide, including Sharon Freedman, MD, Chief of Pediatric Ophthalmology at Duke Health in North Carolina, who recalled a similar case and concurred with the plan of watchful waiting rather than a more aggressive prophylactic course of intervention, believing

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Right to left: Tamiesha Frempong, MD, MPH, and Robin N. Ginsburg, MD, at Mount Sinai's Hess Center for Science and Medicine

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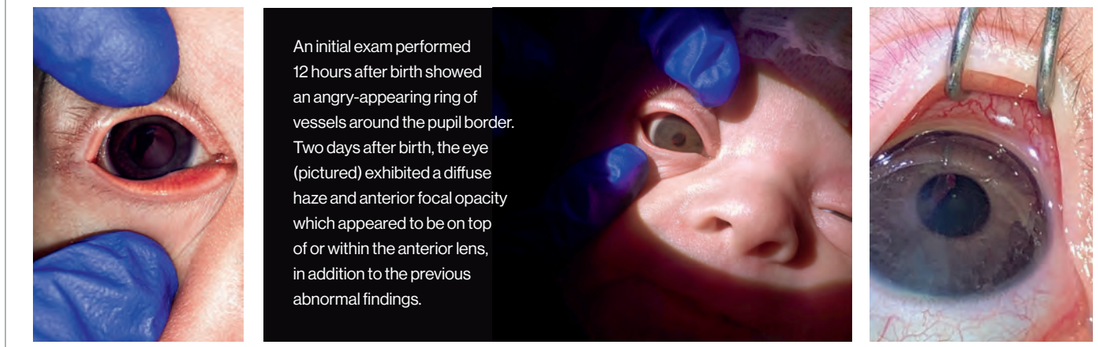

An initial exam performed 12 hours after birth showed an angry-appearing ring of vessels around the pupil border. Two days after birth, the eye (pictured) exhibited a diffuse haze and anterior focal opacity which appeared to be on top of or within the anterior lens, in addition to the previous abnormal findings.

that this was most likely blood and tunica and would soon clear from the eye.

This deliberate outreach was not lost on the patient's father, Jonathan, who was in constant communication with Dr. Frempong over the status of his, and his wife Arielle's, first child. "What we found so amazing was how Dr. Frempong brought in all these specialists, including colleagues from around the country," he notes. "That's one of the benefits of being at a large, academic hospital—the excellent, evidence-based care you're able to get."

The lack of a firm diagnosis in the case, however, made a collective decision on how to proceed exceptionally difficult. One pathway considered was an injection of Avastin, an anti-vascular endothelial growth factor used to address issues of blood vessel proliferation in the eye. But Avastin comes with risks, including the potential for infection and the unknown long-term consequences of administering the agent to an infant.

After weighing all the evidence and relentlessly monitoring the baby's condition, Dr. Frempong and her team decided on a straightforward course of action: watch and wait. "We could tell the patient was headed in the right direction," she says. "We were able to finally see a blood clot on the front part of the lens, and once the blood had cleared, we could see to the back of the lens and notice that the vessels in the iris had started to regress—a good sign."

During the baby's last exam in August, her right lens remained clear, with no residual impact on eyesight. And that could certainly be seen as validation of the team's cautious approach. "Doctoring is not always about the heroics of going in and doing everything possible to resolve a problem whose cause you're not even sure of," emphasizes Dr. Frempong. "Sometimes less is more, and the really important thing is careful monitoring and supporting the patient and family as diligently as possible."

In this case, the patient's father is already a true believer. "Dr. Frempong went above and beyond for us, giving us her personal number and checking on our daughter all the time, even on her days off," says Jonathan. "She's doing beautifully now, and we couldn't be more grateful to Dr. Frempong and the specialists around her."

A Severe Infection Leads to a 'Huge Save' for Surgeon and Her Young Patient

When Amer Stanic, a 15-year-old boy with a severe bilateral eye infection, was referred to Anita Gupta, MD, Director of the Cornea Service at New York Eye and Ear Infirmary of Mount Sinai, his case pushed both patient and doctor to the limits.

Dr. Gupta performing "open sky cataract surgery" on Mr. Stanic

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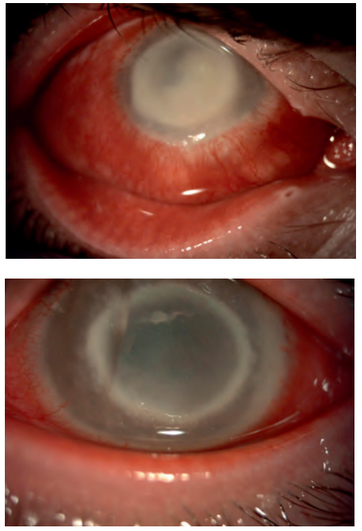
continued from page 33

"Amer had a serious and potentially blinding infection of both his corneas, acanthamoeba keratitis. These amoeba infections are not only exceedingly difficult to treat, but his was among the most severe cases I had ever seen," recalls Dr. Gupta, a seasoned cornea specialist who led the team that provided nonstop support to the patient and his family. "An additional challenge was the emotional aspect: Amer was a healthy young kid with previously excellent vision, who now faced the possibility of permanent blindness."

For the prior two and a half months, the patient had been treated with steroids for what was thought to be a pinkeye-related problem. When it didn't improve, the parents sought a second opinion, and their son was sent to NYEE. "I was very, very scared he could lose his sight in both eyes," admits the boy's father, Edin Stanic. "But the doctors at NYEE were always there for us, and now he's doing extremely well."

NYEE's Ophthalmic Pathology Service was the first stop, to identify the source of the infection. Codrin Iacob, MD, Assistant Director of Pathology, Molecular, and Cell-Based Medicine, made the pivotal diagnosis of acanthamoeba keratitis, a rare infection of the eye caused by a microscopic free-living amoeba that can result in visual impairment or, in the worst case, blindness. The invaders are known to burrow under contact lenses, which seemed likely in this case since the teenager had started wearing lenses less than a year earlier.

An initial examination by Dr. Gupta showed that both corneas were infected, and that the teen's vision had been reduced to counting fingers in the right eye and 20/250 in the left eye. When his condition failed to improve over the next few weeks despite



Fulminant Acanthamoeba Keratitis
Top: Slit lamp photo of the right eye demonstrating dense corneal infiltrate extending to the corneal limbus, with significant conjunctival injection and focal areas of scleral involvement. Visual acuity is counting fingers. **Bottom:** Slit lamp photo of the left eye demonstrating large corneal ring infiltrate with diffuse stromal haze and edema. Visual acuity is 20/250.

various combinations of medicines, including specialty antimicrobial medications compounded by the NYEE pharmacy, Dr. Gupta knew that major surgery would be needed. "I was very concerned about him," she says. "He needed cornea transplant surgery in both eyes emergently. The success rate of the procedure when there is such extensive infection and inflammation is limited to around 30 to 35 percent, with a high chance of donor graft failure as well as other complications. Despite these risks, we had no other choice, and proceeded with surgery in both eyes just four days apart."

Dr. Gupta's concerns were well founded. In the operating room on May 15, 2020, with a pandemic raging outside the walls of the hospital, she first addressed the left eye, considered the more salvageable of the two, performing a penetrating keratoplasty to remove a large 12mm section of infected cornea. But even after that resection—the maximum deemed safe—amoeba remained around the cut edge, threatening to undo the intricate work surgeons had just completed. She sutured the donor graft in place, cauterized around the entire edge to try to kill off more of the microscopic invaders, and left the surgical suite hoping for the best for her young patient.

The scene repeated itself four days later as Dr. Gupta transplanted the cornea of the right eye in an equally difficult procedure. Within three weeks, however, results were apparent. "Amer did remarkably well," Dr. Gupta recounts. "His corneal transplants were healing, and his vision improved significantly. Unfortunately, though, he was still at significant risk for further complications given the persistent infection and scarring in both his eyes." Indeed, as typically happens with acanthamoeba, dying cysts from the remaining infection trigger an overwhelming inflammatory reaction that attacks and kills the cornea graft. This case was no different; at five weeks following surgery, the patient's vision severely regressed as a result of the massive rejection of both corneas.

The uncertainty carried into the summer, when the infection appeared to have cleared but a new problem surfaced: cataracts in both eyes. So, with the patient barely seeing out of either eye, Dr. Gupta began what she refers to as visual rehabilitation. Following the initial surgery to "debulk" the infection and heal the eye, she performed a second cornea transplant on the left eye in October, made increasingly difficult by the scar tissue from the previous procedure. And while the patient's vision improved after the transplant, it was still greatly impaired by the cataract.

Mr. Stanic and Dr. Chen during September follow-up visit

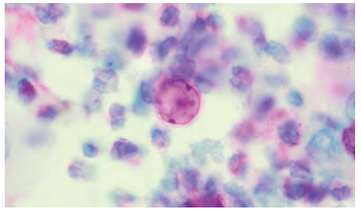


Fig. 1: Oil immersion optic microscopy with Periodic Acid Schiff staining shows an unstained thick capsule of Acanthamoeba cyst with internal labeling of cuticle and organelles in the acute inflammatory background (cytology, original magnification 1000x).

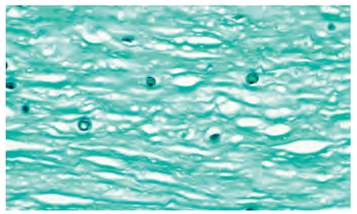


Fig. 2: Gömöri Methenamine Silver staining highlights the thick capsule of the parasitic cysts in all strata of the corneal stroma (histology, original magnification 200x).

The good news was that it set the stage for a turning point in the complex case. Cataract surgery was performed in December 2020 by Steven Rosenberg, MD, a pediatric specialist with NYEE at the time. Following the procedure, the teen's left eye became stable, and his vision returned to 20/30 with regular glasses. That improvement enabled the youth to return to school and some semblance of a normal life. "This was such a huge save, thanks to a tremendous team effort we had in the middle of a pandemic," exults Dr. Gupta, praising the work of her colleagues and residents, including then Chief Resident Masako Chen, MD, who saw the patient day after day while helping the entire family get through the ordeal.

The latest chapter was written on August 19, 2021, when Dr. Gupta returned to the OR with Dr. Chen, now a full-time faculty member and Director of the Comprehensive Ophthalmology Clinic at NYEE, to perform what ophthalmologists call "open sky cataract surgery" to remove the diseased cornea of the right eye and, while it was fully open at 8mm, opportunistically scoop out the cataract in one piece before inserting an intraocular lens and performing another corneal transplant. A follow-up visit in early September showed the teenager's visual acuity as 20/80 at that point with excellent potential for full visual recovery once his eye heals from surgery over the next several months.

The patient can speak best to the outcome, and the journey that preceded it: "There were times that went really well, and others that went really poorly, like when the first cornea was rejected," recalls Amer, now 16. "But after several more surgeries, things are going very well again, and it's been consistent." That steady progress, he adds, has allowed him to return with confidence to his senior year of high school in Brooklyn and resume friendships and activities that had been put on hold.

The encouraging results have also allowed Dr. Gupta a moment of quiet reflection after walking a fine line for so long between giving her patient hope and knowing the odds were stacked against him. "This was one of the more challenging cases I've handled, both because of the severity of Amer's infection and the emotional and social challenges a young teenager faces when losing vision," says Dr. Gupta. "It left me proud for the incredible teamwork we have at NYEE and for the privilege we have as physicians, caring for people during profound moments in their lives."

A New Application of Orbital Brachytherapy Helps a Patient Keep Her Eye and Her Vision

Paul T. Finger, MD, FACS, Founding Director of the Ocular Oncology Service at New York Eye and Ear Infirmary of Mount Sinai (NYEE), is breaking new ground once again with a special "brachy-boost" radiation therapy technique that allows physicians to reduce unnecessary radiation to the normal parts of the eye, thereby saving sight.

A 67-year-old woman with a sebaceous carcinoma in the orbit of her eye provided a textbook case for the effectiveness of this technique. A normal dose of electron beam radiation therapy (EBRT) to the eye and orbit would have resulted in loss of her vision and possibly her eye, but Mount Sinai's "brachytherapy-boost" approach distributed the highest dose to the portion that needed it the most, while relatively sparing the normal parts of the eye. And the results, as described in the July 2021 issue of the *Ophthalmic Plastic and Reconstructive Surgery* journal, were outstanding for both patient and doctor.

"We were able to increase the dose to the tumor bed in the lower orbit, while sparing the surrounding, lower-risk orbital tissue from unnecessary radiation, which would have been catastrophic to the eye," Dr. Finger explains. "It's proof of how a tailored orbital radiation dose delivery can result in local disease control, strong functional outcomes, and excellent cosmesis."

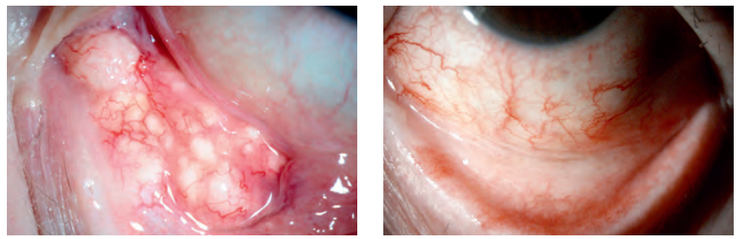


Fig. 1: Top left, slit lamp examination showing the multinodular white mass visible in the inferonasal conjunctival fornix. **Top right,** 1 year following (super thick amniotic membrane graft) implantation and brachytherapy-boost treatment depicting successful epithelialization of the ocular surface and no indications of local recurrence at the conjunctiva.

The technique used by Dr. Finger and Robert Stewart, MD, is known as interstitial orbital brachytherapy-boost because it permits dose escalation to the tumor bed while minimizing radiation to normal ocular tissues. In the case of Dr. Finger's patient, an orbital sebaceous carcinoma the size of a grape (1.4 cm x 1.3 cm) had grown from the orbital tissues around the eye into the left lower eyelid. Dr. Finger initially treated the tumor through orbitotomy resection with cryotherapy, and allowed the site to heal for three weeks before beginning radiation.

Over the following weeks, the regimen of high-dose-rate brachytherapy boost and EBRT was administered by Dr. Stewart, a radiation oncologist, to optimize orbital radiation dose distribution. It resulted in a total cumulative radiation dose of 56 Gy, though the ocular structures further removed from the site of the resection received much less.

At the patient's one-year follow-up visit, the success of the treatment became crystal clear. There was no evidence of orbital tumor, no significant eyelash loss, and no radiation retinopathy or optic neuropathy. Most importantly, the patient is alive with a visual acuity of 20/20.

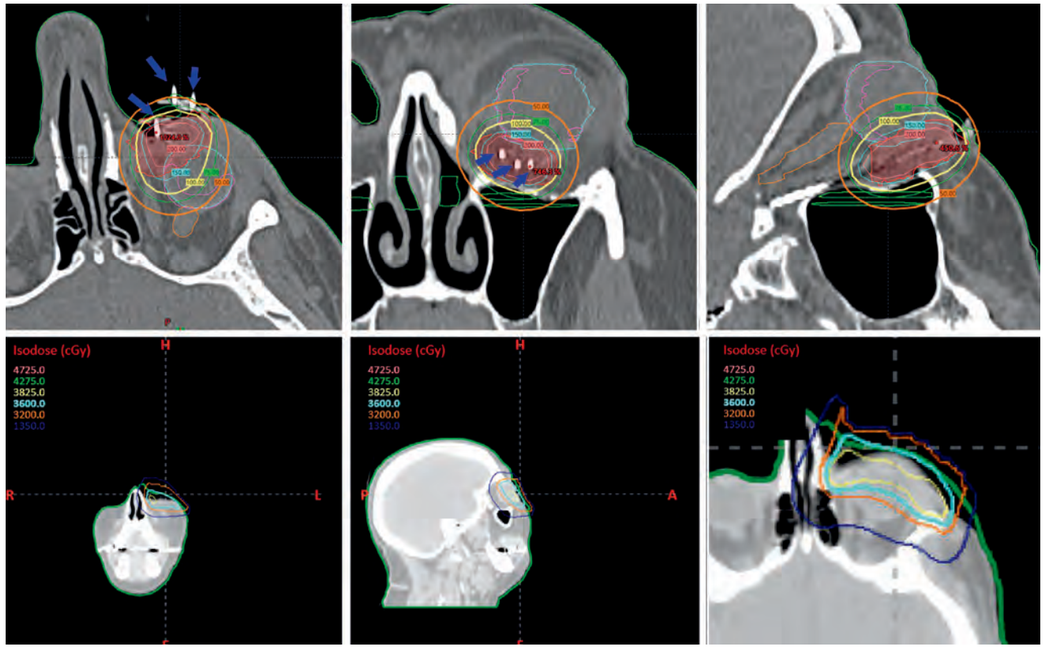


Fig. 2: Top, computed axial tomography shows placement of orbital brachytherapy catheters (blue arrows) and surrounding isodose curves depict the iridium-192 "brachy-boost" dose volume. **Bottom,** computed axial tomography with electron-based EBRT overlay (lower right), a focused transverse view of EBRT field and dose-key. EBRT, external beam radiotherapy.

"Ophthalmic surgeons should be aware that a procedure exists to significantly reduce the radiation dose to normal tissue," says Dr. Finger, who has used a similar technique in the past for patients with melanoma that has spread from the eye to the ocular orbit. "As we've shown repeatedly, brachytherapy-boost is an effective and safe way for patients to keep their eyes, and their vision."

The Ocular Oncology Service, founded by Dr. Finger in 1989, has been a seedbed for the most advanced forms of eye cancer treatment in the world. Among the surgical and therapeutic breakthroughs, Dr. Finger has pioneered the use of topical chemotherapy for conjunctival melanoma, anti-VEGF therapy following radiation, and innovations in radioactive plaque treatment. On the diagnostic side, the Ocular Oncology Service has developed and introduced new applications of ultrasound biomicroscopy, optical coherence tomography, and digital imaging, all designed to identify and target eye cancers with submillimeter precision.

NYEE is now expanding its support to the Ocular Oncology team by adding a talented new faculty member: Ekaterina Semenova, MD, PhD, who completed her residency at NYEE and her fellowship in Ocular Oncology at Duke Eye Center.

Images reproduced by permission: Li, Feng B.A.*; Stewart, Robert D. M.D.†; Finger, Paul T. M.D.*†, Interstitial Brachytherapy for Orbital Sebaceous Carcinoma, Ophthalmic Plastic and Reconstructive Surgery: July 27, 2021 - Volume - Issue - doi: 10.1097/IOP.0000000000002031

Innovative New Eye Stroke Program Proves a 'Godsend' For a Patient

On a warm, sunny morning in early August, Philip Fusciello called an Uber from his home in Jersey City and was driven to a nearby strip mall for a half-day of shopping. What made his outing unusual—extraordinary is a better word—is that the 70-year-old had suffered a crippling stroke in his right eye just two weeks before. Already blind in his other eye from diabetic retinopathy, he was rushed by friends to The Mount Sinai Hospital in Manhattan. There, he became one of the most recent patients in an innovative program for diagnosing and treating central retinal artery occlusion, or CRAO, the ocular equivalent of a cerebral stroke. Almost immediately, Mr. Fusciello started recovering his prior vision.

Developed by New York Eye and Ear Infirmary of Mount Sinai (NYEE) and the Mount Sinai Stroke Center, the program is a broad collaboration between ophthalmologists, the Stroke Service, and Emergency Department physicians within the Mount Sinai Health System. "A central retinal artery occlusion is the most time-sensitive cause of sudden vision loss, and this new program allows us to get a diagnosis more quickly so we can treat patients within a window of time that will increase their chance of success," says Gareth Lema, MD, PhD, Site Director of Quality, Safety, and Experience for the Ophthalmology Department at The Mount Sinai Hospital, and a retinal specialist at NYEE who helped develop the initiative. "Decreasing time to treatment improves the patient's chance of recovering vision."

Untreated, an eye stroke can cause permanent loss of vision in the affected eye. To dissolve the clot, an infusion of tissue plasminogen activator (tPA) must be administered into the ophthalmic artery. But the window of time to intervene to ensure significant visual improvement is very small.

"The key is getting patients on the operating table within the 12-hour window (ideally six hours or less) of safety and efficacy, so that the neuroradiologists can administer intra-arterial tPA," explains Richard B. Rosen, MD, the Belinda and Gerald Pierce Distinguished Professor of Ophthalmology at Icahn School of Medicine at Mount Sinai, Chief of the Retina Service of the Mount Sinai Health System, and Vice Chair and Director of Ophthalmology Research at NYEE. As one of the original developers of the protocol, who championed installing the optical coherence tomography (OCT) scanners at key Emergency Departments to expand access to care, he believes "this protocol is the best option we now have for saving the sight of patients with central retinal artery occlusion."

Unfortunately, a range of factors often delays treatment. Patients who experience a sudden loss of sight in one eye often wait several hours before going to the hospital, hoping the problem will resolve on its own. Physicians, and even some

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Mr. Fusciello in Central Park after his follow-up visit with Dr. Lema following treatment for eye stroke.

continued from page 39

Fig. 1: Mr. Fusciello being examined in the Emergency Department at The Mount Sinai Hospital by a Mount Sinai Stroke Service resident

Fig. 2: Resident administering an OCT scan for a suspected CRAO

ophthalmologists, may not know that an effective treatment exists and is readily available. And even upon arriving in the Emergency Department, diagnosis may be delayed by availability of on-call house staff, time-consuming referrals to an ophthalmologist, and available imaging specialists who can perform fluorescein angiography, traditionally used to diagnose CRAO.

The new eye stroke program overcomes these issues by deploying both tele-ophthalmology and optical coherence tomography (OCT) in an emergency room setting. OCT uses infrared light to produce cross-sectional images of the retina at the resolution of just a few microns. While early versions of

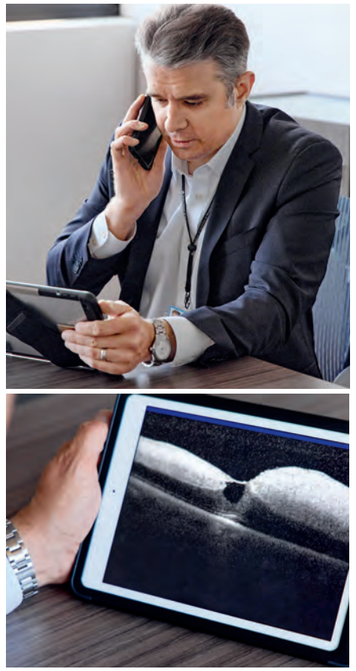

Fig. 3: Dr. Lema, as a retina attending on-call, responds to an alert from the ED regarding a possible CRAO and reviews ocular images from the OCT scan.

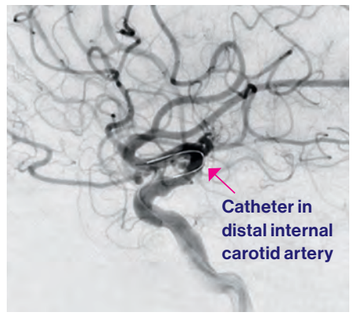

Fig. 4: Angiogram of a catheter being guided by an interventional radiologist into the distal cervical internal carotid artery to administer tPA into the ophthalmic artery

the technology were not especially accessible, newer automated devices have become more portable and user-friendly, facilitating use by providers without specialized training.

With funding from the New York Eye and Ear Infirmary Foundation, the eye stroke program was able to purchase the latest OCT systems for two of the largest emergency departments in the Mount Sinai Health System: The Mount Sinai Hospital and Mount Sinai West. Each site already had a stroke service and capability for endovascular tPA injection. With the new program and protocols in place, frontline staff have been trained to use OCT to assess patients with suspected CRAO. Once these images are collected, stroke team physicians who have gathered at the patient's bedside can upload them to retina specialists at NYEE for immediate review and consultation. This process dramatically speeds up the time to diagnosis and treatment.

Mr. Fusciello was given the clot buster tPA by the stroke service at The Mount Sinai Hospital just under seven hours from the time he left his home in New Jersey. Instantaneously, he began recognizing the shapes of clinicians in the operating room. He was taken to the ICU to monitor for any signs of cerebral stroke, and in the days he was there, vision in his treated right eye kept improving, bringing him back to his baseline vision, which he has maintained since then.

"I've always been independent and able to get around," says Mr. Fusciello, who works part-time at Holy Rosary Church in Jersey City, the oldest Italian Roman Catholic Church in New Jersey. "Just getting back the vision I had before was a godsend for me."

The Surgical Robot Is Learning New Skills

The first microinterventional ophthalmic robotic assistant continues to be a focus of innovation at New York Eye and Ear Infirmary of Mount Sinai (NYEE), as we prepare for pivotal Food and Drug Administration (FDA) trials. Our collaboration with the team of robotics engineers at Preceyes BV, the Dutch company that manufactures the robot, is broadening beyond its current European approval for retinal surgery to include glaucoma and anterior-segment procedures. We are also developing a robotics surgical training curriculum for residents, fellows, and faculty to engage them in this burgeoning technological advance.

"The progress we've made over the past year has been substantial, even in the face of COVID-19," says Gautam Kamthan, MD, Assistant Director of the Ophthalmic Innovation and Technology Program at NYEE, who helped coordinate activities around the robot's arrival from the Netherlands in the summer of 2020, and is now prepping it for a major surgical role. "We've been able to meet all our milestones, including developing the first-ever glaucoma module for any robotic platform. And before long, we'll be the first clinical site in the United States to offer this technology for ophthalmic surgery."

The glaucoma module is a particular source of pride since NYEE's technologists have been integral to its development. Paving the way for this novel surgical module was a $100,000 grant from the New York Eye and Ear Infirmary Foundation.

Mount Sinai Innovation Partners (MSIP) has also contributed critical support to NYEE efforts to advance the ophthalmic surgical robotics program. MSIP, which helps translate Mount Sinai ideas, inventions, and discoveries into commercial products and services that benefit patients, made a meaningful investment in Preceyes and now holds a seat on its board of directors. "We pursued the relationship after identifying its product as highly innovative, and one that could differentiate New York Eye and Ear from other institutions," says Erik Lium, PhD, President, Mount Sinai Innovation Partners. "It's also consistent with our mission to support products that embody patient-centric innovation."

A case in point is the extension of the surgical robot's capabilities to the anterior segment of the eye for gonio-based glaucoma surgery. "This innovation can have a tremendous impact on new glaucoma stents and minimally invasive glaucoma surgery by improving implantation precision and reducing rates of malposition," notes Tsontcho (Sean) Ianchulev, MD, MPH, Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai and Director of the Ophthalmic Innovation and Technology Program at NYEE. "Our glaucoma module can improve surgical precision from 100 microns achievable manually to less than 5 microns." Technicians have completed validation of the module using high-fidelity eye models, he adds, and are now moving to a head-to-head study against conventional manual surgical intervention.

While the goal is to eventually position the module for FDA trials, that out-of-the-gate task will be handled first by the robotic assistant's retinal component. The FDA trial for which the robot is now being prepped revolves around epiretinal membrane peeling, a delicate procedure to

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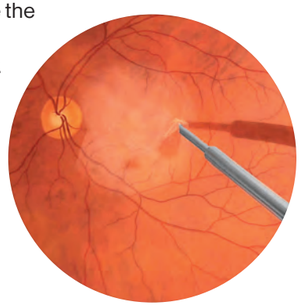
Gautam Kamthan, MD, demonstrating the modified robot using a Kahook Dual Blade to remove the trabecular meshwork to NYEE residents Shravan Savant, MD, and Maria Castanos, MD.

remove the micron-thin sheets of cells that grow over and distort the macula, reducing central vision. To evaluate the precision and accuracy of the robot in complex surgical procedures, NYEE is testing the device in the Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center, using the virtual reality EyeSi Surgical simulator.

The study will compare its impact in different user groups—including experienced retinal surgeons, fellows, residents, and, intriguingly, video gamers—to perform the epiretinal membrane peel with and without the assistance of the robot. In preparation, each group is given a half-hour of training on the procedure using the simulator. For comparative purposes, they will perform the same surgery and surgical maneuvers manually on the EyeSi simulator. "The results should be quite interesting given that one comparative group consists of gamers who have no surgical experience, but are very skilled at using a joystick, like the one on the simulator," remarks Dr. Ianchulev.

"The special training course that's being created for the robotic assistant will help train the next generation of ophthalmic surgeons in a technology that is rapidly sweeping through other surgical subspecialties. It will have applications for gene implantation, retinal intravascular interventions, and micromanipulations currently beyond the reach of the best of today's manual surgery. It will enable a new level of precision and repeatability for tasks that require slow, delicate surgical acrobatics needed to reach our next level of sight-saving therapies," states Richard B. Rosen, MD, Vice Chair and Director of Ophthalmology Research at NYEE, and Chief of Retina Service at Mount Sinai Health System.

According to Dr. Kamthan, the plan is to eventually integrate robotic training into NYEE's ophthalmic surgical curriculum, based on the enormous interest residents and residency applicants have already shown. Among other things, he stresses, "it will be a major attraction for prospective residents and fellows when they're considering where to train. We'll be able to offer them the only robotic training program of its type in the world."



The EyeSi Surgical simulator in the Buxton Microsurgical Education Center allows ophthalmic surgeons and trainees to practice epiretinal membrane peeling.

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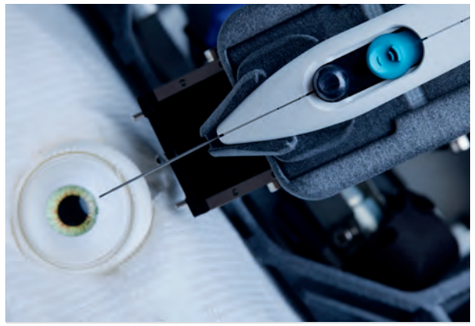
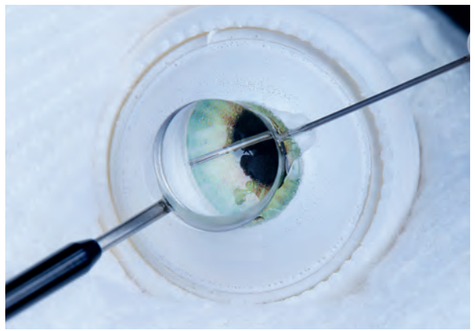
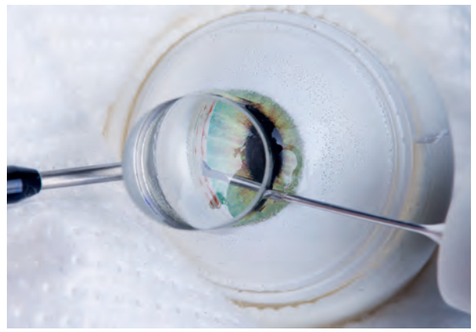




iStent Inject Trabecular Bypass Shunt Device

Top: The Preceyes Robotic Surgical System (PRSS) is positioned for entry into the anterior chamber of the model eye. Although initially designed for vitreoretinal surgery, the platform has been successfully adapted for the anterior segment. The iStent Inject Trabecular Bypass Shunt is a first-of-its-kind minimally invasive glaucoma surgery (MIGS) apparatus that is currently the most implanted MIGS device. Challenges remain with implantation technique and a high rate of malposition. The trabecular meshwork is about 100 microns in size which makes it difficult for conventional manual gonio-surgery. The micron-level robotic precision is 10x higher than what is possible with unaided human dexterity and can enable a categorically higher resolution of surgical intervention.

Bottom: After the robot enters the anterior chamber, the surgeon places a lens onto the surface of the eye, coupled with clear gel to enable visualization of the patient's trabecular meshwork, the target of the iStent. A hurdle to effective implantation is a surgeon's natural resting tremor. At this microscopic scale, a tremor can decide whether the implant is a success or not. However, with the robot's greater improvement in stability over even the best human hands, the surgeon has the opportunity to ensure the sights of the injector are exactly where they want them before they shoot.



Kahook Dual Blade Device

Top: While the iStent is the most commonly implanted MIGS device, the Kahook Dual Blade® (KDB) is the most commonly used non-implanted MIGS device. We wanted to demonstrate feasibility with both approaches using the robot. The KDB works by removing the trabecular meshwork of the angle in a sweeping motion. When performed manually, the procedure suffers when the surgeon traumatizes surrounding tissues and cuts too deep causing bleeding. The robot is perfectly poised to accomplish such a task, however, as it can be programmed to travel along a route or have a virtual barrier beyond which it cannot go.

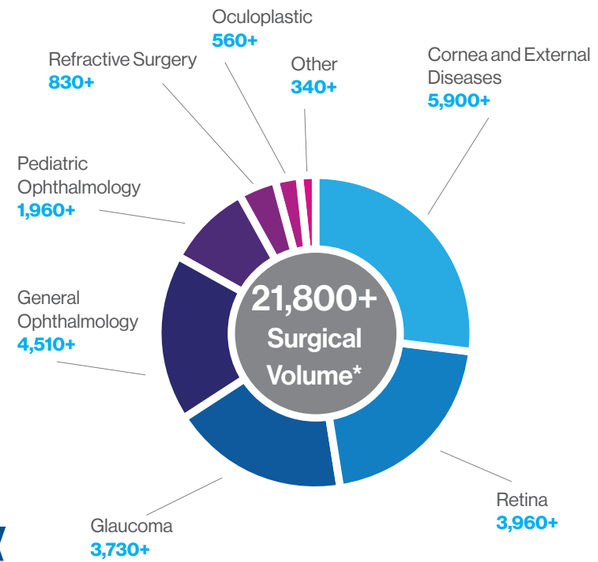
Bottom: Again, the lens is placed onto the eye to allow a clear view of the trabecular meshwork. In this image, the robot has engaged the trabecular meshwork with the hook-shaped aspect of the blade and is removing it. Through our modifications of the robot, we have been able to achieve extreme angles of reach within the anterior chamber using the KDB. Almost 180 degrees can be treated with a single sweep. Most surgeons can only do 90 to 120 degrees manually. Not only can the surgeon achieve greater reach and maneuverability but can also pause and focus on re-adjusting the lens to maintain a clear view. Once readjusted, the surgeon can pick up right where they left off to complete the procedure because the robot kept the device in the exact same place.

Department of Ophthalmology at a Glance: New York Eye and Ear Infirmary of Mount Sinai (NYEE) and The Mount Sinai Hospital (MSH) / Icahn School of Medicine at Mount Sinai

NYEE No. 12 in the nation in Ophthalmology

(Highest in NYC) by *U.S. News & World Report* "Best Hospitals" rankings

BEST HOSPITALS U.S.News & WORLD REPORT OPHTHALMOLOGY 2021-22



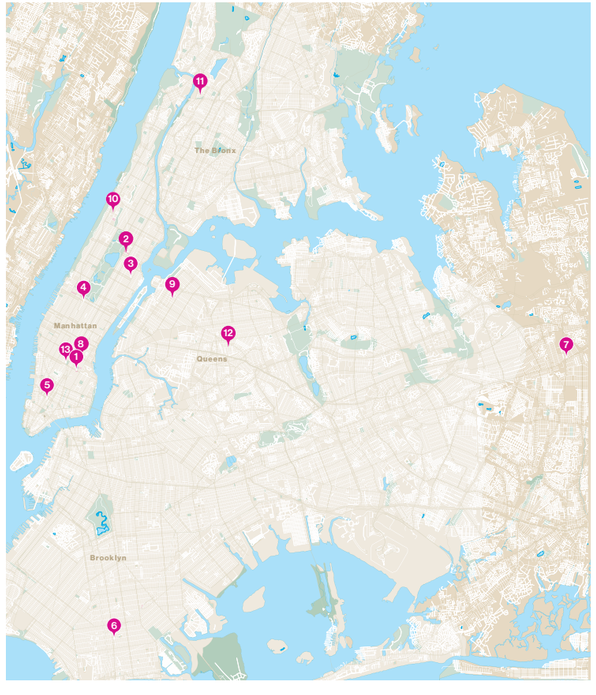
2020-2021 STATISTICS*

- 32 **Residency Positions**
- 7 **Fellowship Positions**
  One of the largest ophthalmology graduate medical education programs in the country.
- 16 **Funded Clinical Trials**
- 179,440+ **Outpatient Visits**

* Combined 2020 (Jan-Dec) and 2021 (Jan-Jun) numbers for NYEE and MSH. Lower volume reflects suspension of elective cases in New York State for approximately 3 months (mid-March through mid-June 2020) and other regulatory restrictions as a result of COVID-19 pandemic.

Locations

1. **New York Eye and Ear Infirmary of Mount Sinai**
   310 East 14th Street
   New York, NY 10003
2. **NYEE-East 102nd Street**
   17 East 102nd Street
   New York, NY 10029
3. **NYEE-East 85th Street**
   234 East 85th Street
   New York, NY 10028
4. **NYEE-Columbus Circle**
   200 West 57th Street
   New York, NY 10019
5. **NYEE-Tribeca**
   77 Worth Street
   New York, NY 10013
6. **NYEE-Midwood**
   1630 East 15th Street
   Brooklyn, NY 11229
7. **NYEE-Mineola**
   200 Old Country Road
   Mineola, NY 11501
8. **NYEE After-Hours Emergency Service at MSBI ED**
   281 1st Avenue
   New York, NY 10003



Affiliated Clinical Sites

9. **Mount Sinai Queens**
   25-10 30th Avenue
   Long Island City, NY 11102
10. **Mount Sinai Morningside**
    440 West 114th Street
    New York, NY 10025

Affiliated Teaching Institutions

11. **James J. Peters VA Medical Center**
    130 West Kingsbridge Road
    Bronx, NY 10468
12. **NYC Health+Hospitals/Elmhurst**
    79-01 Broadway
    Queens, NY 11373
13. **Mount Sinai-Union Square**
    10 Union Square East
    New York, NY 10003

ACCOLADES

James C. Tsai, MD, MBA, received a 2021 Life Achievement Honor Award from the American Academy of Ophthalmology. The Academy's Board of Trustees recognizes select recipients for their contributions to the organization, its scientific and educational programs, and the field of ophthalmology. As an internationally recognized physician-scientist and experienced health care administrator, Dr. Tsai also began his two-year term as President of the International Joint Commission on Allied Health Personnel in Ophthalmology in August 2021.

In addition to serving as chair of the Glaucoma Subcommittee of the National Eye Health Education Program Planning Committee of the National Institutes of Health, Dr. Tsai is also an elected member of the American Ophthalmological Society and elected fellow of the New York Academy of Medicine, where he currently chairs its Section on Ophthalmology.

Dr. Tsai joined Mount Sinai Health System in 2014 as President of NYEE and Delafield-Rodgers Professor and System Chair of Ophthalmology, Icahn School of Medicine at Mount Sinai.

Louis R. Pasquale, MD, FARVO, was appointed as the Shelley and Steven Einhorn Distinguished Chair in Ophthalmology at NYEE and the Icahn School of Medicine at Mount Sinai. As the Chair, Dr. Pasquale will serve as Director of the Einhorn Clinical Research Center, as well as continuing as Director of the Mount Sinai/New York Eye and Ear (NYEE) Eye and Vision Research Institute. In these dual roles, Dr. Pasquale will continue to lead the strategic efforts to advance the Department of Ophthalmology into the global ophthalmology and visual sciences research network of the Mount Sinai Health System.

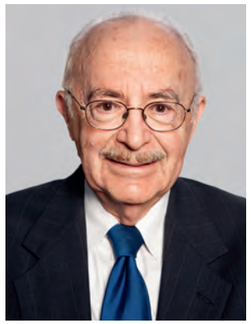
Dr. Pasquale joined Mount Sinai in 2018 as Professor of Ophthalmology and Site Chair of Ophthalmology at The Mount Sinai Hospital and Mount Sinai Queens. Dr. Pasquale is a member of the editorial boards of *PLOS One, Journal of Glaucoma, Ophthalmology Glaucoma, International Glaucoma Review, Asia-Pacific Journal of Ophthalmology,* and the *American Journal of Ophthalmology.* He served as a member of the National Institutes of Health's National Advisory Eye Council. He is also the Association for Research in Vision and Ophthalmology (ARVO) Glaucoma Section Trustee and a Gold Fellow of ARVO.

Mark Kupersmith, MD, an internationally recognized leader in clinical ophthalmic research, received the 2021 ARVO Xtreme Research Award. Dr. Kupersmith accepted the award as part of an interdisciplinary group of clinicians and researchers for their longstanding research in "Ocular Imaging with SD-OCT for Raised Optic Disc Evaluation." This Award recognizes their highly innovative research related to the advancement of understanding of disorders of the optic nerve head using optical coherence tomography.

After joining the Department of Ophthalmology in 1980, Dr. Kupersmith established the Neuro-Ophthalmology Service at NYEE, and in 2005, along with a national team, created NORDIC (Neuro-Ophthalmology Research Disease Investigator Consortium). Dr. Kupersmith serves as Vice Chair, Translational Ophthalmology Research, and Chief, Neuro-Ophthalmology Service, Mount Sinai Health System.

RETIREES

This year the Department of Ophthalmology said goodbye to two outstanding physicians who collectively served Mount Sinai and the NYC community for more than 120 years. We thank them for their years of service and dedication to the field of ophthalmology, Mount Sinai, and the patients they served.



Ira Eliasoph, MD
Comprehensive Ophthalmology
71 years of service

Upon completing his training in general surgery, Dr. Eliasoph served in the United States Navy as a Medical officer on Navy transport ships. He received his postgraduate degree in Ophthalmology at NYU-Postgraduate Medical School followed by a residency in Ophthalmic Surgery at Mount Sinai School of Medicine. Dr. Eliasoph served as Chief of Eye Plastic Surgery at the Bronx Veterans Hospital and as Chief of Ophthalmology at The Jewish Home and Hospital, and held the title of Associate Clinical Professor in the Department of Ophthalmology at Icahn School of Medicine at Mount Sinai. A gifted clinician and innovator, Dr. Eliasoph is an author of many peer-reviewed articles, many of which are still cited today, and over the years has developed novel surgical techniques and designed new surgical instruments for ophthalmic surgery. In addition to his passion for teaching ophthalmology residents, geriatric fellows, and internists, Dr. Eliasoph is a proud member of the Cogan Ophthalmic History Society, authoring several papers on the history of ophthalmology and creating the society's logo.

Joel S. Mindel, MD
Neuro-Ophthalmology
51 years of service

Dr. Mindel received his medical degree from the University of Maryland followed by a residency at the University of Michigan, where he returned to achieve his M.S. in Ophthalmology. After completing a fellowship in Neuro-Ophthalmology at Columbia-Presbyterian Hospital, he completed a second fellowship in Ocular-Pharmacology at the Icahn School of Medicine at Mount Sinai, where he then received his Ph.D. in Pharmacology. Dr. Mindel was a Professor of Neuro-Ophthalmology, an Associate Professor of Pharmacology, and Director of Neuro-Ophthalmology at the Medical School. In addition, he has served as the Chief of the Ophthalmology Section at the Bronx Veterans Administration Hospital. Among his many accomplishments, Dr. Mindel was a consultant to the FDA Dermatologic and Ophthalmic Drugs Advisory Committee and served as a delegate from both Mount Sinai and the American Academy of Ophthalmology to the US Pharmacopeial Convention. In addition to serving on the Editorial Board and Editorial Advisory Board for *Ophthalmology*, Dr. Mindel has been a co-editor of both the Ocular Pharmacology Section of *Duane's Biomedical Foundations of Ophthalmology* as well as the Therapeutic Reviews Section for *Survey of Ophthalmology*.

In recognition of his many years of service, Dr. Mindel was appointed Professor Emeritus of Ophthalmology at Icahn School of Medicine at Mount Sinai upon his retirement.

NEW RECRUITS

Timothy A. Blenkinsop, PhD
Basic Science/Translational Research
Associate Professor, Icahn School of Medicine at Mount Sinai
Doctorate and Master of Science: New York University, School of Medicine

Masako Chen, MD
Cornea, External Diseases, and Refractive Surgery
Director, Comprehensive Ophthalmology Clinic, NYEE
Assistant Professor, Icahn School of Medicine at Mount Sinai
Residency: New York Eye and Ear Infirmary of Mount Sinai;
Fellowship: Bascom Palmer Eye Institute

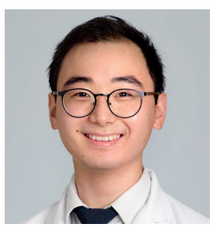
Kristina Creadore, OD
Comprehensive Ophthalmology
Instructor, Department of Ophthalmology, Icahn School of Medicine at Mount Sinai
Doctor of Optometry: State University of New York College of Optometry;
Residency: University of Virginia Health System

Rachel H. Lee, MD
Glaucoma
Assistant Professor, Icahn School of Medicine at Mount Sinai
Residency: New York Eye and Ear Infirmary of Mount Sinai;
Fellowship: Bascom Palmer Eye Institute

Trisha Mor, MD
Medical Retina
Medical Director, Ophthalmology, MSM and MSW, Assistant Professor, Icahn School of Medicine at Mount Sinai **Residency and Fellowship:** St. Luke's-Roosevelt Hospital Center

Thomas J. Quehl, MD
Pediatric Ophthalmology
Assistant Professor, Icahn School of Medicine at Mount Sinai
Residency and Fellowship: New York Eye and Ear Infirmary of Mount Sinai

Ekaterina Semenova, MD, PhD
Ocular Oncology
Assistant Professor, Icahn School of Medicine at Mount Sinai
Residency: New York Eye and Ear Infirmary of Mount Sinai; **Fellowship:** Duke Eye Center



Vincent Sun, MD
Medical and Surgical Retina
Assistant Professor, Icahn School of Medicine at Mount Sinai
Residency: McGill University;
Fellowship: New York Eye and Ear Infirmary of Mount Sinai

NYEE RESIDENTS

PGY-4

Julia Fallon, MD
Roxanne Lee, MD
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Tommaso Vagaggini, MD
Bella Wolf, MD

PGY-3

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Laura Barna, MD
Nitin Chopra, MD
Jeanette Du, MD
Mona Fayad, MD
Giselle Lynch, MD
Michael Schatz, MD

PGY-2

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Jerry Hsu, MD
Sefy Paulose, MD
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Daniel Vail, MD
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PGY-4

Rupak Bhuyan, MD
Karina Esquenazi, MD
Susel Oropesa, MD
Kevin Wu, MD

PGY-3

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Retina

Richard B. Rosen, MD
Chief, Retina, MSHS

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Vincent Sun, MD

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Varun K. Pawar, MD

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Director, Mount Sinai/NYEE Eye and Vision Research Institute, MSHS

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Director, Posterior Segment Trauma Service, NYEE

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Associate Director of Ophthalmology, Elmhurst Hospital

New York Eye and Ear Infirmary of Mount Sinai

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Mount Sinai West

NYEE
New York Eye and Ear Infirmary of Mount Sinai

Celebrating 200 YEARS 1820 – 2020

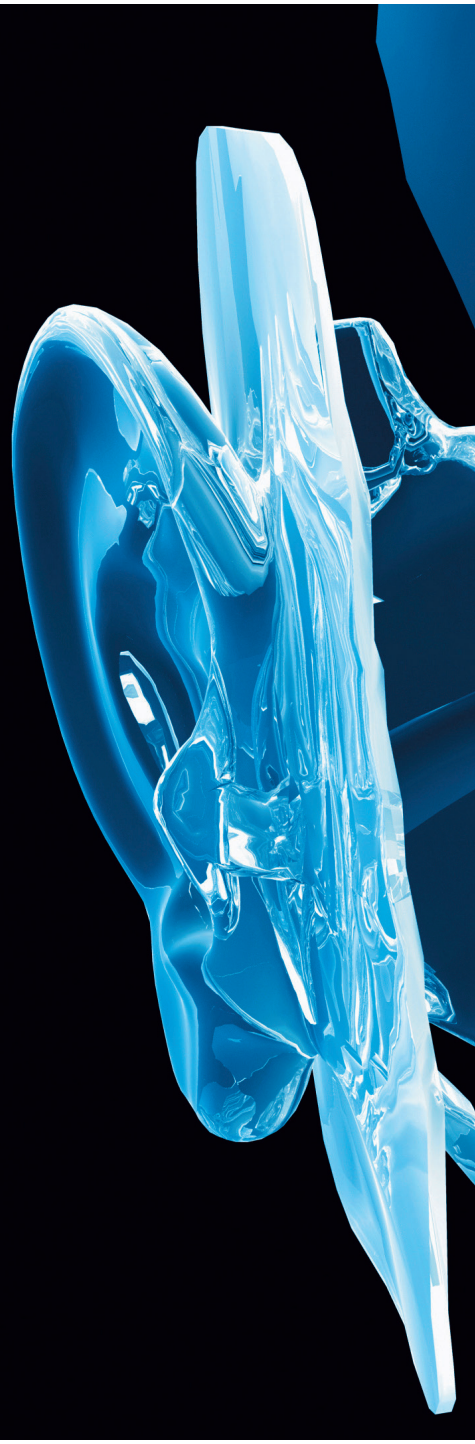
New York Eye and Ear Infirmary of Mount Sinai

NYEE Bicentennial Gala

The Mount Sinai Health System continues to remain committed to the safety and well-being of our patients and community. After much discussion and deliberation, we have made the difficult decision to cancel the New York Eye and Ear Infirmary of Mount Sinai's Bicentennial Gala scheduled for March 24, 2022.

Mount Sinai proudly recognizes the contributions of countless physicians, scientists, researchers, administrators, staff and benefactors whose unwavering commitment and passion for service has allowed NYEE to flourish for the past two centuries. NYEE remains committed to its founding mission of serving the community.

Please consider supporting NYEE's mission to enhance patient care, deliver world-class education, conduct pioneering research, and lead innovation by making a donation at www.nyee.edu.



HYBRID MEETING

Transformational Ophthalmology 2022: Envisioning Our Third Century Symposium*

New York Academy of Medicine
1216 5th Avenue
New York City, NY

Friday, March 25, 2022

For information about the speakers, program, and registration, visit: https://cmetracker.net/NYEE/catalog or call 917-270-7571.

* **In-Person Attendance Policy:** All in-person meeting participants must be fully vaccinated and must wear masks at all times. By registering for and attending the meeting, each participant affirms that they will comply with all CDC, federal, state, and local laws, orders, directives, and institutional guidelines related to COVID-19 and attending a large gathering.

We will continue to monitor the U.S. Centers for Disease Control and Prevention (CDC) and U.S. state and local health authorities for the latest public health updates, as well as applicable restrictions on events and gatherings. We plan to hold this meeting in hybrid format but reserve the right to convert it to a 100% virtual event if health and safety restrictions require it. We will update the registrants and the website should the plans for this event change.